1997

Revised

EV1™

Chassis

Service Manual

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CAUTION

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of all motor vehicles. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure, or tool that is not recommended by the vehicle manufacturer must first determine that neither his safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure, or tool selected.

It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during service or repair or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive; it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

This vehicle has a high voltage power system. Disabling the system is required when working on or around the high voltage system and high voltage battery pack (other than testing the system using the procedures in this manual).

To help avoid severe shocks and burns and vehicle damage, always follow the cautions in this manual to disable the high voltage system. See the high voltage disable and enable procedure in the front of this service manual.

This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to "CAUTIONS" under "On-Vehicle Service" and the SIR Component and Wiring Location views in the "SIR Service Manual" before performing service on or around SIR components or wiring. Failure to follow "CAUTIONS" could result in possible air bag deployment, personal injury, otherwise unneeded SIR system repairs.

To help avoid accidental air bag deployment and personal injury, when servicing a vehicle that requires repair of the SIR system and another vehicle system, it is recommended that the SIR be repaired first using service manual procedures.

CAUTION

Saturn Service Manuals are intended for use by professional, qualified technicians. Attempting repairs or service without the appropriate training, tools, and equipment could cause injury to you or others and damage to your vehicle that may cause it not to operate.

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CHASSIS

NOTICE

Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application.

The applicable service procedure will identify, where necessary, those fasteners that must be replaced after removal; or those fasteners that require thread lockers or thread sealant.

UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener.

When you install fasteners, use the correct tightening sequence and specifications.

Following these instructions can help you avoid damage to parts and systems.

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NOTES

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GLOSSARY OF ACRONYMS

Acronym	Definition
ABS	Anti-Lock Braking System
AM	Amplitude Modulation
Amp	Ampere
APM	Accessory AC and DC Power Control Module. With PIM, makes up PEB
APS	Auxiliary Power Supply (part of APM)
BCA	Bias Control. Assembly
BPM	Battery Pack Module
BRS	Battery Reserve Switch
BTCM	Brake/Torque Control Module
BTSI	Brake Transmission Shift Interlock (GM)
CD	Compact Disc
cfm	Cubic Feet per Minute
cg	Center of Gravity
CHMSL	Center High-Mount Stop Lamp
CMC	Compressor Motor Controller (part of APM)
CPA	Connector – Positive Assurance
CR	Charge Receptacle
CRFM	Condenser Radiator Fan Module (part of HPVS)
CTPS	Check Tire Pressure System
DC	Direct Current
DLC	Data Link Connector
DERM	Diagnostic and Energy Reserve Module (SIR control module)
DIA	Dealer Installed Accessory
DM	Drive Motor
DRL	Daytime Running Light
E/M	English/Metric
ECM	Engine Control Module (used with internal combustion engines)
EHPS	Electro-Hydraulic Power Steering
EKP	External Keypad
EMB	Electro-Magnetic Brake (part of ABS)
EMI	Electromagnetic Interference
EPS	Electric Power Steering. Also see EHPS

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GLOSSARY OF ACRONYMS CONTINUED

Acronym	Definition
ETS	Electronic Traction System
EV	Electric Vehicle
EVO	Electronic Variable Orifice Control
FLIP	Forward Lamp – Instrument Panel Harness. Name of major EV low voltage wire harness
FM	Frequency Modulation
FOD	Front of Dash
g	Gram
GFI	Ground Fault Interrupt
GVMR	Gross Vehicle Mass Rating
GVW	Gross Vehicle Weight
HPVM	Heat Pump Ventilation Module
HPVS	Heat Pump Ventilation System. Similar to HVAC on ICE vehicles
HTCM	HPVS/Thermal Control Module
HV	High Voltage
HVAC	Heating, Ventilating, and Air Conditioning (on ICE vehicles. For EV, see HPVS).
HWS	Heated Windshield
HWS	Hand Wheel Sensor
Hz	Hertz (cycles per second)
IC	Integrated Circuits
ICE	Internal Combustion Engine
IGBT	Isolate Gate Bipolar Transistor
I/O	Input(s)/Output(s)
IP	Instrument Panel
ISRV	Inside Rear View (mirror)
JB	Junction Block
KAM	Keep Alive Memory
kg	Kilogram
km	Kilometer
km/h	Kilometers per hour

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GLOSSARY OF ACRONYMS CONTINUED

Acronym	Definition
kPa	Kilo Pascals
kW	Kilowatt
kWh	Kilowatt–hour
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Left Front
LH	Left Hand
LHD	Left Hand Drive
LHJB	Left Hand Junction Block
LR	Left Rear
LVW	Loaded Vehicle Weight
m	Meter
MMC	Metal Matrix Composite (Rear Brake Drum Material)
MHz	Megahertz
mi	Mile(s)
MPH	Miles Per Hour
MSRP	Manufacturers Suggested Retail Price (includes dealer preparation)
MUX	Multiplex or Multiplexer
N	Newton(s)
NTF	No Trouble Found. Reported failure does not reoccur under test
OEM	Original Equipment Manufacturer
OSRV	Outside Rear View (mirror)
PCM	Propulsion Control Module (Drive Motor)
PDT	Portable Diagnostic Tool
PEB	Power Electronics Bay
PIM	Power Inverter Module
POA	Part of Assembly
PRND	Park–Reverse–Neutral–Drive, as in PRND Selector
PROM	Programmable Read Only Memory
PSOC	Pack State of Charge
PTC	Positive Thermal Coefficient. Term for resistive heating module
PWM	Pulse Width Modulation, or Pulse Width Modulated

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GLOSSARY OF ACRONYMS CONTINUED

Acronym	Definition
QDM	Quad Driver Module
RAM	Random Access Memory
RAP	Retained Accessory Power
RF	Right Front
RF	Radio Frequency
RH	Right Hand
RH	Relative Humidity
RHJB	Right Hand Junction Block
RMS	Root-Mean-Squared
ROM	Read Only Memory
RP	Reduced Performance
RPM	Revolutions Per Minute
RR	Right Rear
RSA	Run/Lock Shifter Assembly
SAE	Society of Automotive Engineers
SDL	Serial Data Link
SDM	Sensor Diagnostic Module
SIR	Supplemental Inflatable Restraint (air bag) system
SLA	Short-Long Control Arm (suspension system)
SOC	State of Charge (battery pack). Usually expressed as a percentage
SN	Service Now
SSPO	Saturn Service Parts Operation
SS	Service Soon
SWA	Steering Wheel Angle
TNF	Trouble – Not Found. Reported failure reoccurs but cause cannot be determined
TJB	Trunk Junction Block
TOD	Time of Day
TPA	Terminal – Positive Assurance
T/S	Turn Signal
TT	Telltale

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GLOSSARY OF ACRONYMS CONTINUED

Acronym	Definition
UART	Universal Asynchronous Receiver – Transmitter (communications IC)
UH	Under Hood
ULEV	Ultra-Low Emissions Vehicle
USOL	User State of Charge
V5B	5 Volt Supply
VAC	Voltage, Alternating Current
VF	Vacuum Fluorescence
VH	Vehicle Handling
VIN	Vehicle Identification Number
VTD	Vehicle Theft Deterrent
W	Watt
WSS	Wheel Speed Sensor (part of ABS)
WSW	Windshield Washer/Wiper
ZEV	Zero Emission Vehicle

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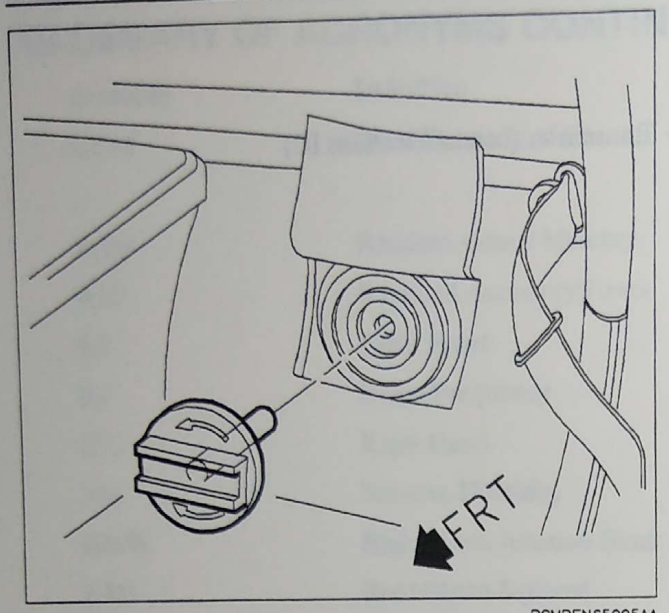

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HIGH VOLTAGE DISABLE

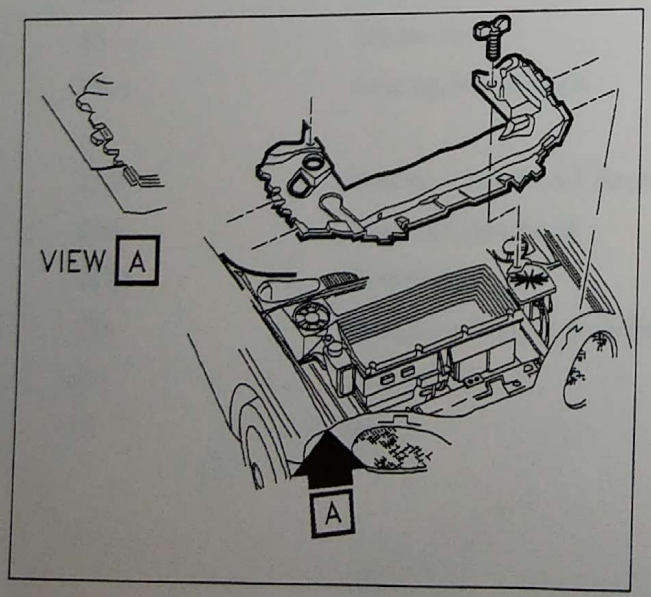
REMOVAL

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Place the vehicle in the "RUN" mode.
2. Remove the manual disconnect knob.
   a. Tilt the drivers seat forward.
   b. Raise the carpet flap, located on the battery tunnel behind the drivers seat.
   c. Turn the manual disconnect knob counterclockwise and pull the manual disconnect knob straight out.

IMPORTANT: An audible click should be heard when turning the manual disconnect knob. This click indicates the automatic disconnect relays have opened.

3. Verify high voltage has been removed.
   a. Connect scan tool to the data link connector (DLC) and run the High Voltage special test. Battery pack module (BPM) diagnostic trouble codes (DTCs) 312, 280 and/or 275 should be present, which indicates BPM and auto disconnect recognized a high voltage disconnect.
   b. If test fails, refer to service manual "High Voltage Special Test Failed" in the "Battery and Charging System Service Manual."
4. Remove engine compartment sight shield.



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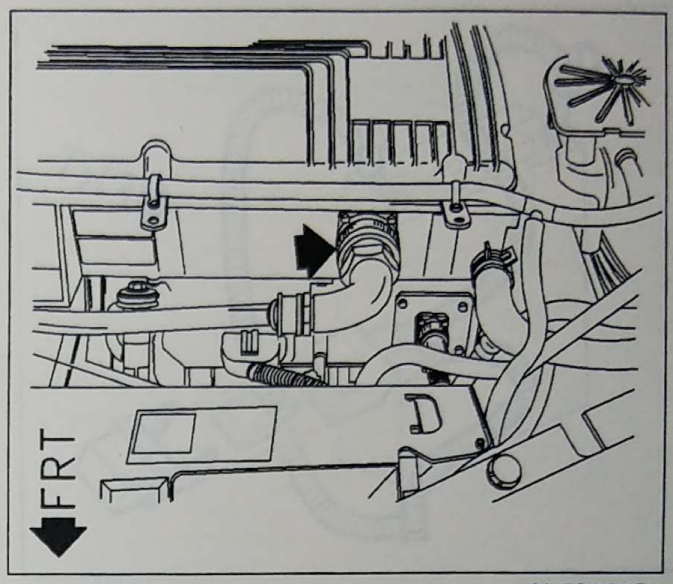
CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, ALWAYS ASSUME THE HIGH VOLTAGE IS PRESENT WHEN DISCONNECTING THE CHARGE RECEPTACLE TO PIM CONNECTOR. DO NOT ALLOW THE CONNECTOR BODY TO TOUCH THE PINS OF THE PIM WHEN REMOVING THE CONNECTOR.

5. Remove the charge receptacle to power inverter module (PIM) cannon connector using one hand.



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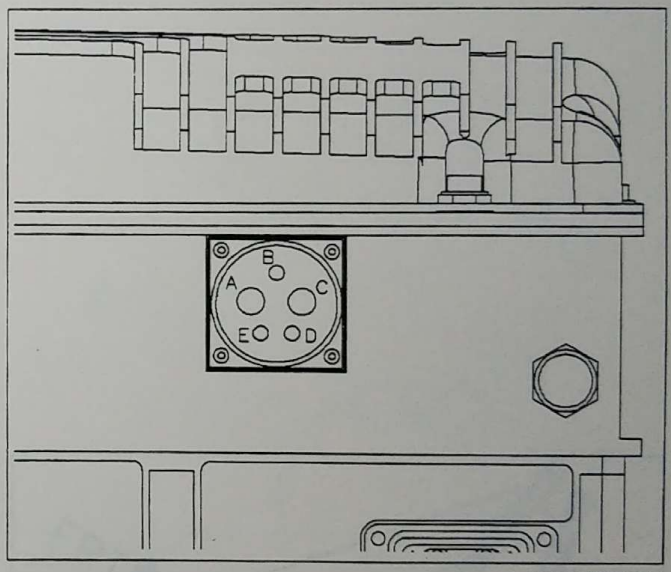
6. Using a DVOM and only one hand, measure from pin A of the PIM to chassis ground and from pin C of the PIM to chassis ground and from pin A to C. All measurements should be less than 10 volts. Pin C and Pin A are the large high voltage pins on the PIM.
   a. If the voltage is less than 10 volts, high voltage system is disabled.
   b. If the voltage is greater than 10 volts, refer to the "High Voltage" section in the "Battery and Charging Service Manual."



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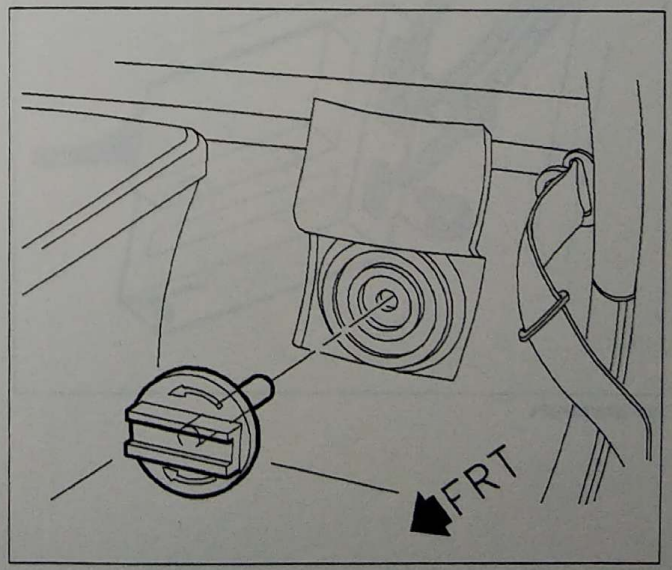
HIGH VOLTAGE ENABLE

INSTALLATION

1. Install charge receptacle to PIM cannon connector.
2. Install engine compartment sight shield.
3. Tilt driver's seat forward.
4. Raise the carpet flap, located on the battery tunnel behind the driver's seat.
5. Install the manual disconnect knob by pushing the shaft straight into the hole and turning clockwise.
6. Clear all DTCs using the scan tool.



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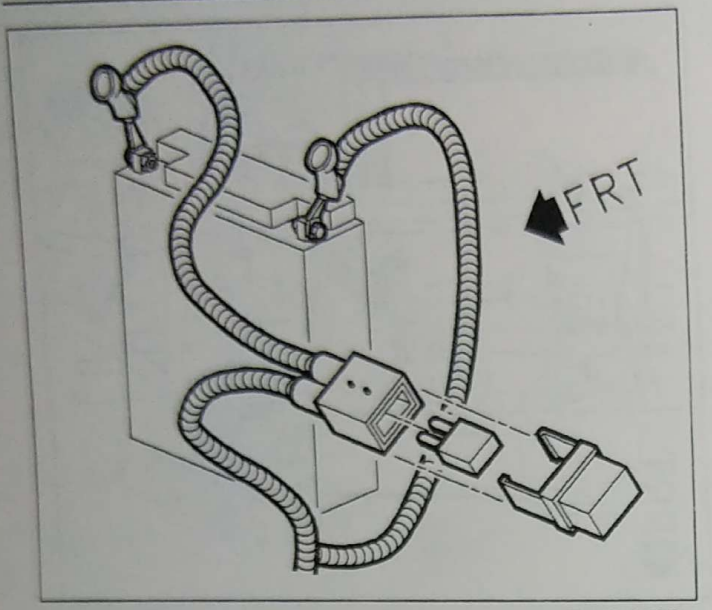

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12 VOLT SYSTEM DISABLE

CAUTION: DISABLE THE 12 VOLT ELECTRICAL SYSTEM TO HELP AVOID PERSONAL INJURY OR POSSIBLE DAMAGE.

IMPORTANT: The key pad must be in the LOCK mode for two minutes prior to performing the following step. Failure to do so could result in the loss of memory that retains the battery pack state of charge. If this occurs refer to "Battery Pack and Charging System" service manual for details.

1. Remove the cover on the 60 amp maxi fuse holder located in the negative auxiliary battery cable.
2. Remove the 60 amp maxi fuse.

12 VOLT SYSTEM ENABLE

1. Install 60 amp maxi fuse located on the negative auxiliary battery cable
2. Place cover on maxi fuse holder.

SIR SYSTEM

ON VEHICLE SERVICE

SERVICE PRECAUTIONS

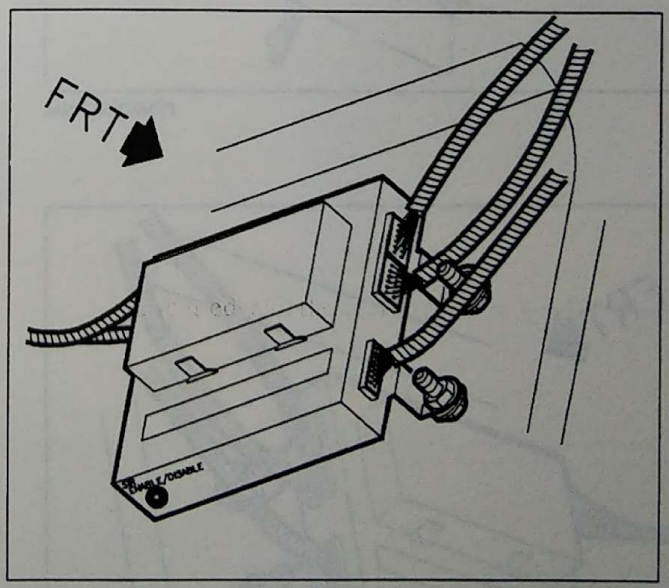
CAUTION: WHEN PERFORMING SERVICE ON OR AROUND SIR COMPONENTS OR SIR WIRING FOLLOW THE PROCEDURE BELOW TO TEMPORARILY DISABLE THE SIR SYSTEM. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SIR SYSTEM REPAIRS.

THE SENSING AND DIAGNOSTIC MODULE (SDM) CAN MAINTAIN SUFFICIENT VOLTAGE TO CAUSE A DEPLOYMENT FOR UP TO *10 MINUTES* AFTER THE KEY PAD HAS BEEN PLACED IN THE "LOCK" MODE, ALSO IF THE AUXILIARY BATTERY IS DISCONNECTED OR THE SIR "ENABLE/DISABLE" SWITCH IS PLACED IN THE DISABLE POSITION. MANY OF THE SERVICE PROCEDURES REQUIRE THE SIR "ENABLE/DISABLE" SWITCH TO BE PLACED IN THE "DISABLE" POSITION AND DISCONNECTION OF THE DEPLOYMENT LOOPS TO AVOID AN ACCIDENTAL DEPLOYMENT.

DISABLING THE SIR SYSTEM

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Place the key pad in the **LOCK** mode.
3. Place the SIR **"ENABLE/DISABLE"** switch in the right hand junction block in the **DISABLE** position.

IMPORTANT: With the SIR **ENABLE/DISABLE** switch in the **DISABLE** position and the key pad in the RUN mode, the AIR BAG telltale lamp will be "On." This is normal operation and does not indicate an SIR system malfunction.



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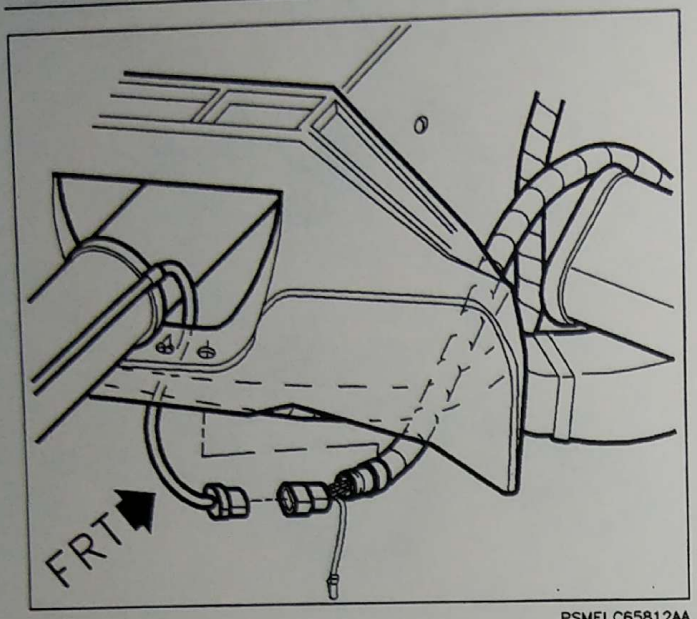

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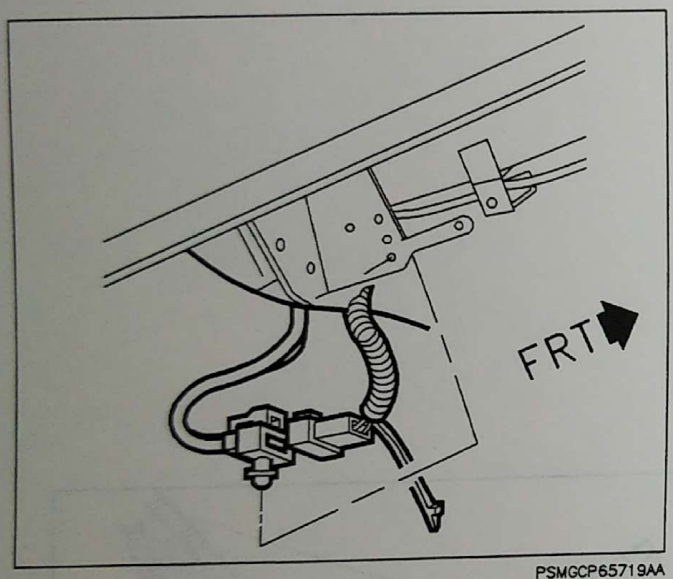
4. Remove connector position assurance (CPA) device and disconnect yellow two-way connector located near the base of the steering column.



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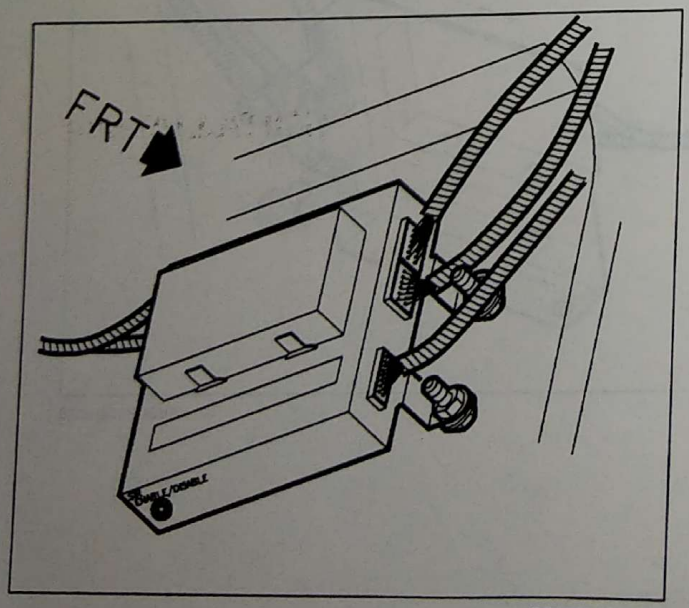
5. Remove connector position assurance (CPA) device and disconnect yellow two-way connector located on passenger inflator module pigtail under RH side of I/P.



PSMGCP65816AB

ENABLING THE SIR SYSTEM

1. Place key pad in the **LOCK** mode.
2. Connect yellow two-way SIR connector at the base of steering column and install connector position assurance (CPA) device to connector.
3. Connect yellow two-way passenger inflator module pigtail and install connector position assurance (CPA) to connector.
4. Place SIR **ENABLE/DISABLE** switch to the **ENABLE** position, located in the RH junction block.
5. Place key pad in the "RUN" mode and verify that the AIR BAG telltale lamp flashes seven times as the key pad is placed in the "RUN" mode and then goes Off. If lamp does not operate as described above perform the "SIR Diagnostic System Check" in this manual.

CHASSIS SERVICE TOOLS

TOOL NUMBER	TOOL DESCRIPTION
EV9706S	Front Horizontal Bushing Removal/Installation
EV9707C	Electrohydraulic Power Steering Analyzer
EV9701Z	Power Steering – A/C Compressor Electrical Tester
EV9708E	Drive Motor Support Adaptor Kit
EV9711E	Drive Motor Support/Liftplate
EV9709S	Strut Spring Compressor Adaptor
EV9710S	Cradle to Body Alignment Tool
EV9716S	Front Stabilizer Link Socket
SA9132S	Lower Control Arm Ball Stud Separator
SA9304NE	Brake Pedal Effort Gauge
EV9713Z	Junction Block Ground Strap
EV9735Z	Digital Insulation Tester

TOOL NUMBER	TOOL DESCRIPTION
SA9217NE	Chassis Ear Tool
SA9155S	Strut Spring Compressor
SA91107NE	Wheel Stud Remover
SA9218NE	Steering Wheel Puller
SA91108NE	Universal Tube Bender
SA9140E	Torque Angle Gauge
SA9150BR	Brake Bleeder Adapter
SA91100C	Tie Rod Separator
SA9193BR	Brake Line Flaring Kit
SA9209C	Inner Tie Rod Wrench
SA9201BR	Drum Brake Adjusting Tool
SA9164C	Steering Gear Clamp Installer
SA9105E	3 Bar Engine Support Fixture
SA91112T	Seal Protector

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FASTENER USAGE

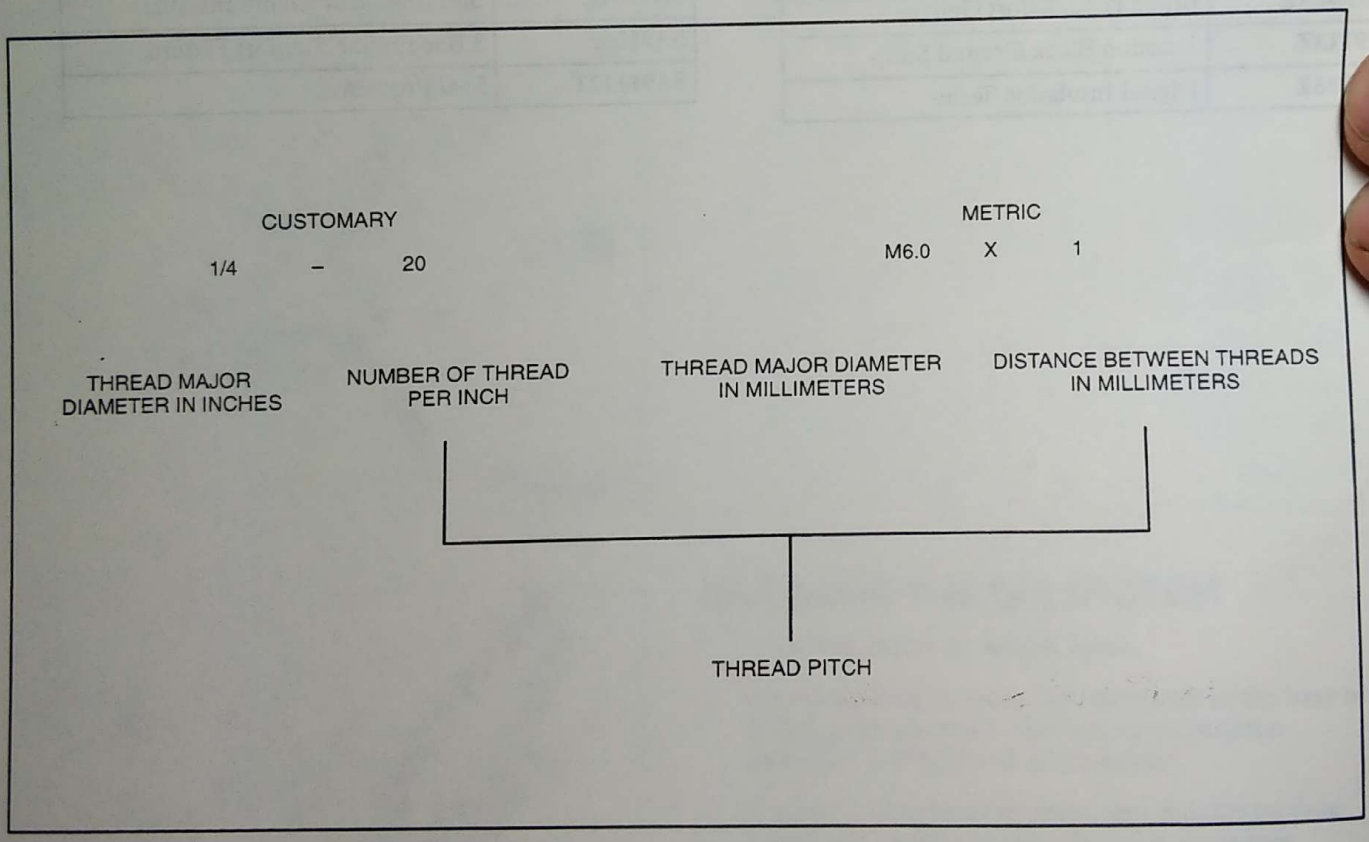
NOTICE: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. Saturn Corporation will call out those fasteners that require replacement after removal. Saturn Corporation will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplement coatings (paint, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

All fasteners used on the EV1 are metric and are very close in dimension to well−known customary fasteners in the inch system. It is important that replacement fasteners have the correct nominal diameter, thread pitch, protective coating, and strength.

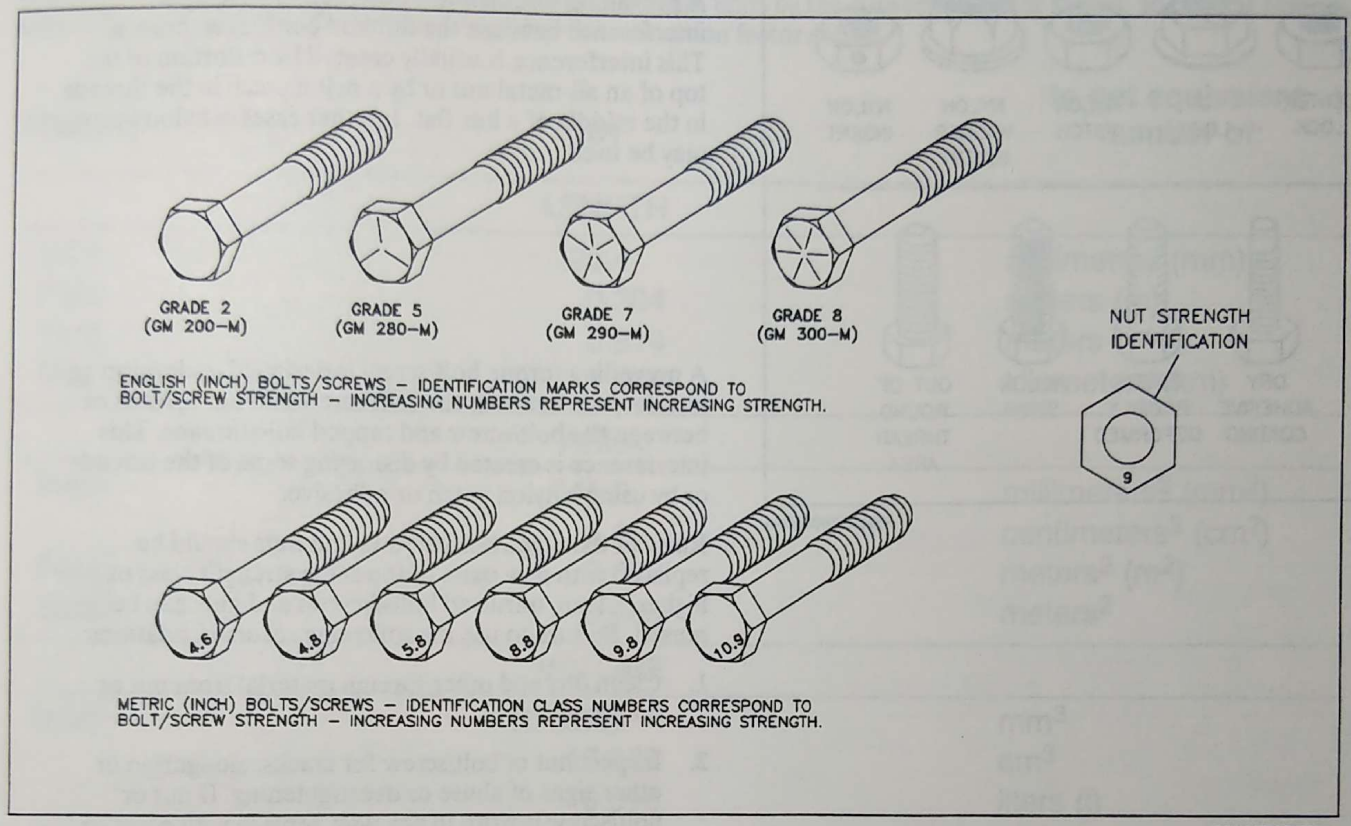
Original equipment metric fasteners, identified by a number marking, show the strength of the material on the fastener. Some beauty fasteners, such as exposed retainer clips and cross−recess head screws may not be identified.

The most commonly used metric strength property classes are 9.8 and 10.9 with the class identification embossed on the head of each bolt. Some metric nuts are marked with strength identification numbers on the nut face. It is extremely important to select replacement fasteners that are designed for the application. Each fastener has been selected to meet performance goals for each joint. The fastener strength, diameter, thread pitch, finish, length, head type and diameter are all equally important variables. Any deviation from the specified replacement part could jeopardize joint integrity.

Saturn Service Parts Organization (SSPO) is a supplier of high quality original equipment replacement fasteners for EV1. If fasteners are purchased from aftermarket suppliers, they must also posses the stringent quality requirements for use on the EV1



FASTENER STRENGTH IDENTIFICATION



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Most commonly used metric fastener strength property classes are 9.8 and 10.9. The class identification is embossed on the head of each bolt/screw. English fastener strength property classes range from grade 2 to 8. Radial lines are embossed on the head of each bolt/screw to identify the strength class. Some metric nuts are marked with strength identification numbers on the nut face.

When replacing fasteners, be careful to use bolts/screws and nuts of a strength class equal to, or higher than, the original fasteners (the same number marking or higher).

Also select replacement fasteners of the correct size. Correct replacement bolts/screws and nuts are available through Saturn Service Parts Operation (SSPO).

Many metric fasteners available in the aftermarket parts channels were designed to metric standards of countries other than the United States. The fasteners may have different strength or thread pitch and may not have the numbered head marking system. The metric fasteners used on GM products are designed to new international standards that might not be used by some nondomestic bolt/screw and nut suppliers.

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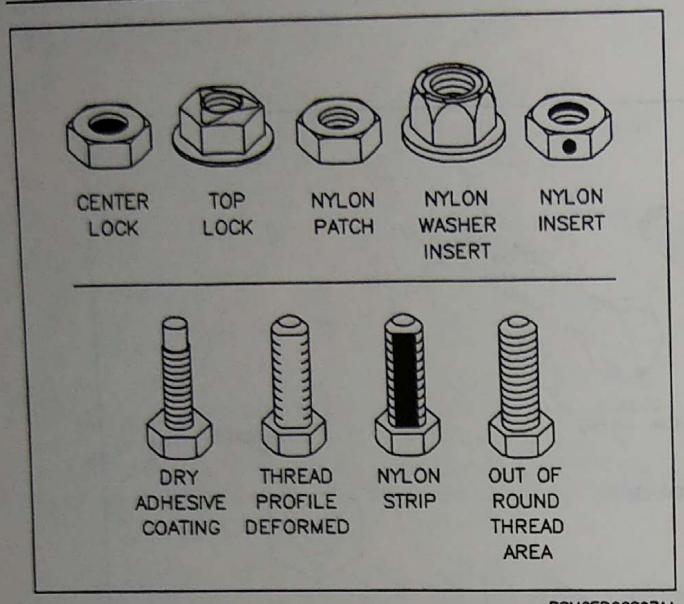

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PREVAILING TORQUE FASTENERS

A prevailing torque nut is designed to develop a interference between the nut and bolt/screw threads. This interference is usually created by distortion of the top of an all-metal nut or by a nylon patch in the threads in the middle of a hex flat. In other cases, a nylon insert may be used.

A prevailing torque bolt/screw is designed to develop an interference between the bolt/screw and nut threads or between the bolt/screw and tapped hole threads. This interference is created by distorting some of the threads or by using a nylon patch or adhesive.

Rusty or damaged bolts/screws and nuts should be replaced with new parts of the same strength class or higher. Clean, unrusted bolts/screws and nuts can be reused. Be sure to use the following recommendations:

1. Clean dirt and other foreign material from nut or bolt/screw.
2. Inspect nut of bolt/screw for cracks, elongation or other signs of abuse or overtightening. If nut or bolt/screw is worn in any way, replace with a nut or bolt/screw of the same strength class or higher.
3. Assemble the parts and hand-start nut or bolt-screw.
4. Check that nut or bolt/screw fails to develop the proper torque before it seats. If nut or bolt/screw fails to develop torque correctly, replace with a nut or bolt/screw of the same strength class or higher.
5. Tighten fastener to the torque specified in the appropriate installation procedure in this manual.

FASTENER TYPE	TORQUE UNITS	METRIC-SIZE FASTENERS							
		6	6.3	8	10	12	14	16	20
NUTS AND ALL METAL BOLTS/SCREWS	N•m	0.4	0.4	0.8	1.4	2.2	3.0	4.2	7.0
	Lb. In.	4	4	7	12	19	27	37	62
ADHESIVE OR NYLON COATED BOLTS/SCREWS	N•m	0.4	0.4	0.6	1.2	1.6	2.4	3.4	5.6
	Lb. In.	4	4	5	11	14	21	30	50
FASTENER TYPE	**TORQUE UNITS**	**INCH-SIZE FASTENERS**							
		.250	.312	.375	.437	.500	.562	.625	.750
NUTS AND ALL METAL BOLTS/SCREWS	N•m	0.4	0.6	1.4	1.8	2.4	3.2	4.2	6.2
	Lb. In.	4	5	12	16	21	28	37	55
ADHESIVE OR NYLON COATED BOLTS/SCREWS	N•m	0.4	0.6	1.0	1.4	1.8	2.6	3.4	5.2
	Lb. In.	4	5	9	12	16	23	30	49

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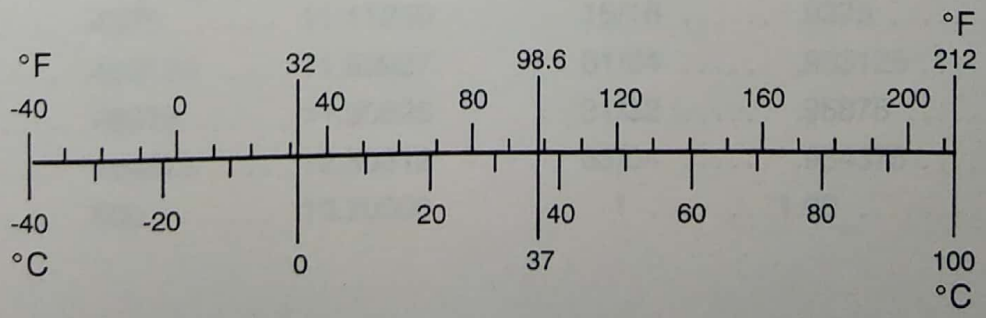
ENGLISH-METRIC CONVERSIONS

To convert English units to Metric units, multiply the English units by the conversion factor shown. To convert Metric units to English units, divide the Metric units by the conversion factor shown.

Multiply	by	to get equivalent number of:
	LENGTH	
Inch	25.4	millimeters (mm)
Foot	0.304	meters (m)
Yard	0.914	meters
Mile	1.609	kilometers (km)
	AREA	
$Inch^2$	645.2	$millimeters^2$ (mm^2)
	6.45	$centimeters^2$ (cm^2)
$Foot^2$	0.092	$meters^2$ (m^2)
$Yard^2$	0.836	$meters^2$
	VOLUME	
$Inch^3$	16 387.0	mm^3
	16.387	cm^3
	0.016	liters (l)
Quart	0.946	liters
Gallon	3.785	liters
$Yard^3$	0.764	$meters^3$ (m^3)
	MASS	
Pound	0.453	kilograms (kg)
Ton	907.18	kilograms (kg)
Ton	0.907	tonne (t)
	FORCE	
Kilogram	9.807	newtons (N)
Ounce	0.278	newtons
Pound	4.448	newtons
	TEMPERATURE	
Degree Fahrenheit (°F)	(°F-32) ÷ 1.8	Degree Celsius (C)



ENGLISH-METRIC CONVERSIONS (CONTINIED)

Multiply	by	to get equivalent number of:
	ACCELERATION	
Foot/sec^2	0.305	meter/sec^2 (m/s^2)
Inch/sec^2	0.025	meter/sec^2
	TORQUE	
Pound-inch	0.113	newton-meters (N•m)
Pound-foot	1.356	newton-meters
	POWER	
Horsepower	0.746	kilowatts (kW)
	PRESSURE OR STRESS	
Inches of water	0.248	kilopascals (kPa)
Pounds/sq. in.	6.895	kilopascals
	ENERGY OR WORK	
BTU	1 055.	joules (J)
Foot-pound	1.356	joules
Kilowatt-hour	3 600 000. or 3.6 x 10^6	joules (1 joule = one watt–second)
	LIGHT	
Foot candle	10.76	lumens/meter^2 (lm/m^2)
	FUEL PERFORMANCE	
Miles/gal	0.425	kilometers/liter (km/l)
Gal/mile	2.353	liter/kilometer (l/km)
	VELOCITY	
Miles/hour	1.609	kilometers/hr. (km/h)

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DECIMAL AND METRIC EQUIVALENTS

Fractions	Decimal In	Metric MM	Fractions	Decimal In	Metric MM
1/64	.015625	.39688	33/64	.51625	13.09687
1/32	.03125	.79375	17/32	.53125	13.49375
3/64	.046875	1.19062	35/64	.546875	13.89062
1/16	.0625	1.58750	9/16	.5625	14.28750
5/64	.078125	1.98437	37/64	.578125	14.68437
3/32	.09375	2.38125	19/32	.59375	15.08125
7/64	.109375	2.77812	39/64	.609375	15.47812
1/8	.125	3.17500	5/8	.625	15.87500
9/64	.140625	3.57187	41/64	.640625	16.27187
5/32	.15625	3.96875	21/32	.65625	16.66875
11/64	.171875	4.36562	43/64	.671875	17.06562
3/16	.1875	4.76250	11/16	.6875	17.46250
13/64	.203125	5.15937	45/64	.703125	17.85937
7/32	.21875	5.55625	23/32	.71875	18.25625
15/64	.234375	5.95312	47/64	.734375	18.65312
1/4	.250	6.35000	3/4	.750	19.05000
17/64	.265625	6.74687	49/64	.765625	19.44687
9/32	.28125	7.14375	25/32	.78125	19.84375
19/64	.296875	7.54062	51/64	.796875	20.24062
5/16	.3125	7.93750	13/16	.8125	20.63750
21/64	.328125	8.33437	53/64	.828125	21.03437
11/32	.34375	8.73125	27/32	.84375	21.43125
23/64	.359375	9.12812	55/64	.859375	21.82812
3/8	.375	9.52500	7/8	.875	22.22500
25/64	.390625	9.92187	57/64	.890625	22.62187
13/32	.40625	10.31875	29/32	.90625	23.01875
27/64	.421875	10.71562	59/64	.921875	23.41562
7/16	.4375	11.11250	15/16	.9375	23.81250
29/64	.453125	11.50937	61/64	.953125	24.20937
15/32	.46875	11.90625	31/32	.96875	24.60625
31/64	.484375	12.30312	63/64	.984375	25.00312
1/2	.500	12.70000	1	1.00	25.40000

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LIFTING, JACKING, AND SUPPORT POINTS

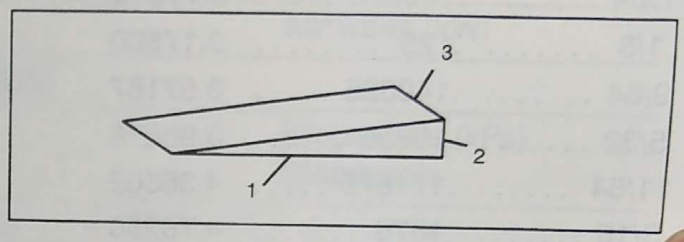
CAUTION: TO HELP AVOID PERSONAL INJURY WHEN A VEHICLE IS ON A HOIST, PROVIDE ADDITIONAL SUPPORT FOR THE VEHICLE. THIS WILL REDUCE THE POSSIBILITY OF THE VEHICLE FALLING OFF THE HOIST.

CAUTION: TO HELP AVOID PERSONAL INJURY, ALWAYS USE JACK STANDS WHEN WORKING ON OR UNDER ANY VEHICLE THAT IS SUPPORTED ONLY BY A FLOOR JACK OR A HOIST.

NOTICE: When lifting with a frame contact hoist, and battery pack removal is not necessary, lift the vehicle on the body side frame-lower pinch weld flanges at specific lift locations. (Location views on next page).

NOTICE: Because of the uniqueness of the design of the EV1 and its ground clearance, it is necessary to follow the hoisting directions very carefully. With an inground two post front and rear hoist, it may be necessary to use either low profile arms or ramps as needed in the front lift pad area to keep the fascia from being damaged when approaching or leaving the hoisting area. Ramp size needed:

1. **1050 mm in length (41-3/8 in.)**
2. **155 mm in height (6-7/64 in.)**
3. **230 mm in width (9-1/16 in.)**

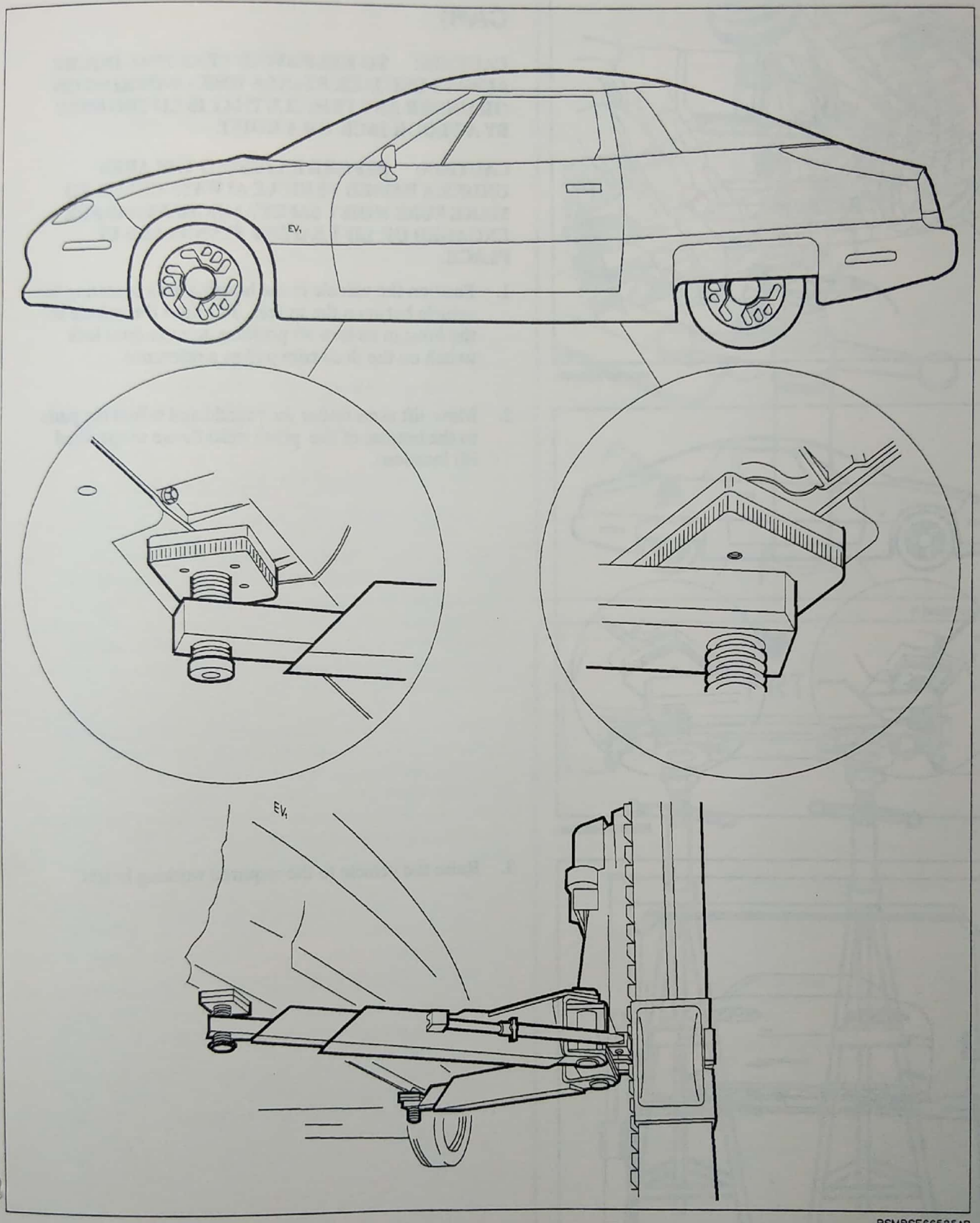


NOTICE: When lifting with a suspension contact hoist, position the front hoist lift pads under the lower control arms. Lift from under the rear tires for rear suspension. (Refer to "Hoisting/Lifting for a Two Post In Ground Hoist Front and Rear" in this section for more information and illustrations.)

When battery pack removal is required, the use of two rear lift pad adaptors must be used. These lift pad adaptors are obtainable from:

General Motors Dealer Equipment
Telephone: 1-800–GM–TOOLS

GENERAL INFORMATION



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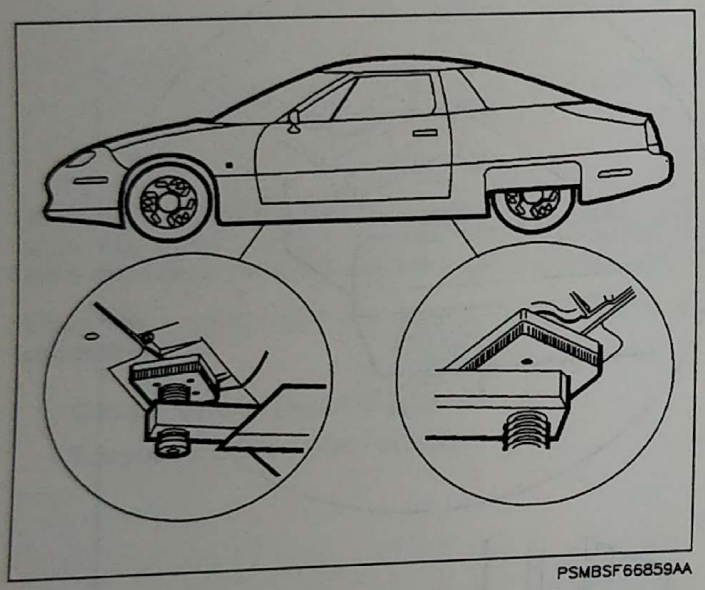

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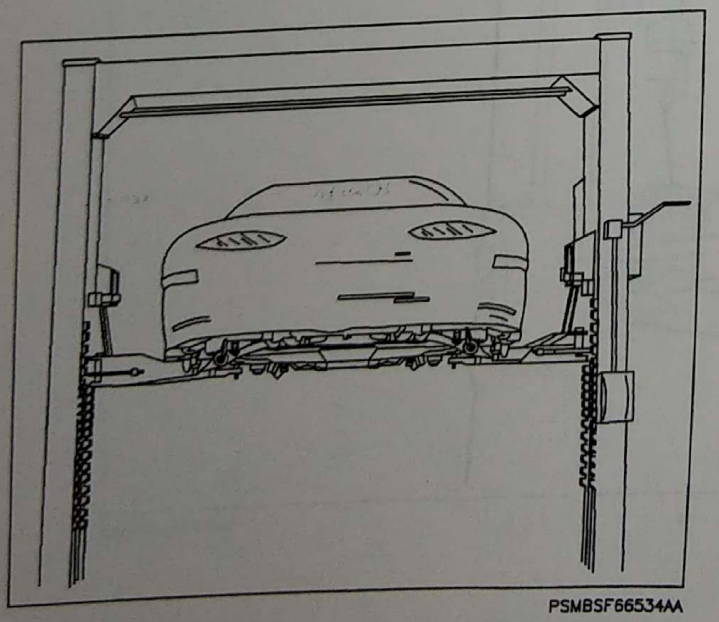

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HOISTING/LIFTING FOR A 2 POST ABOVE GROUND HOIST - (SIDE CAR)

CAUTION: TO HELP AVOID PERSONAL INJURY, ALWAYS USE JACK STANDS WHEN WORKING ON OR UNDER ANY VEHICLE THAT IS LIFTED ONLY BY A FLOOR JACK OR A HOIST.

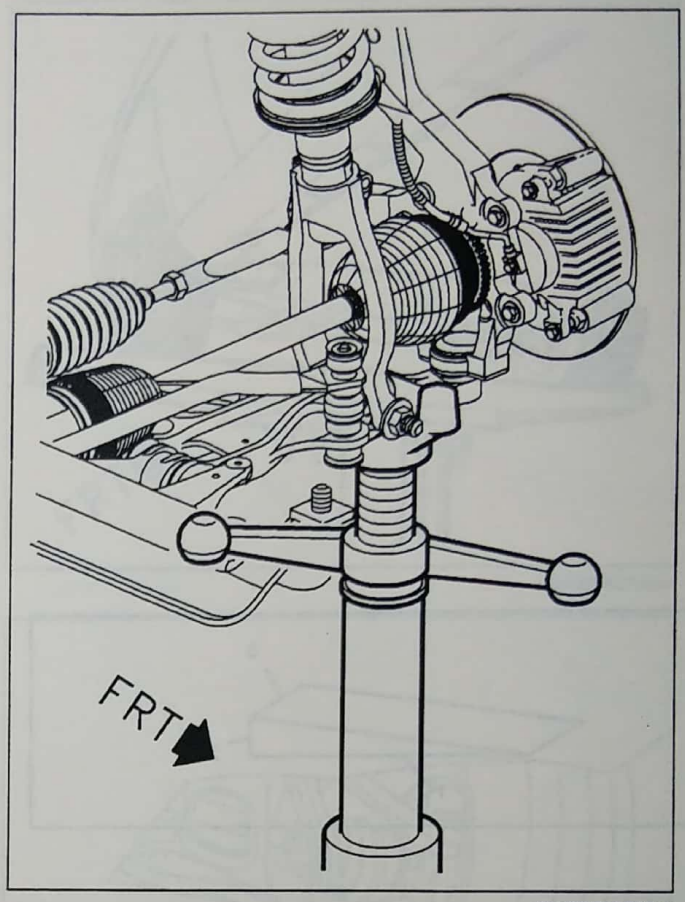
CAUTION: BEFORE ENTERING THE AREA UNDER A RAISED VEHICLE ALWAYS CHECK TO MAKE SURE HOIST SAFETY MECHANISMS ARE ENGAGED OR LIFT SAFETY STANDS ARE IN PLACE.

1. Position the vehicle in the hoisting area centering the vehicle between the towers. To center the vehicle to the hoist in its fore aft position, use the door lock switch on the door trim pad as a reference.

2. Move lift arms under the vehicle and adjust the pads to the bottom of the pinch weld flange at specified lift locations.

3. Raise the vehicle to the required working height

4. Position safety stands in place.



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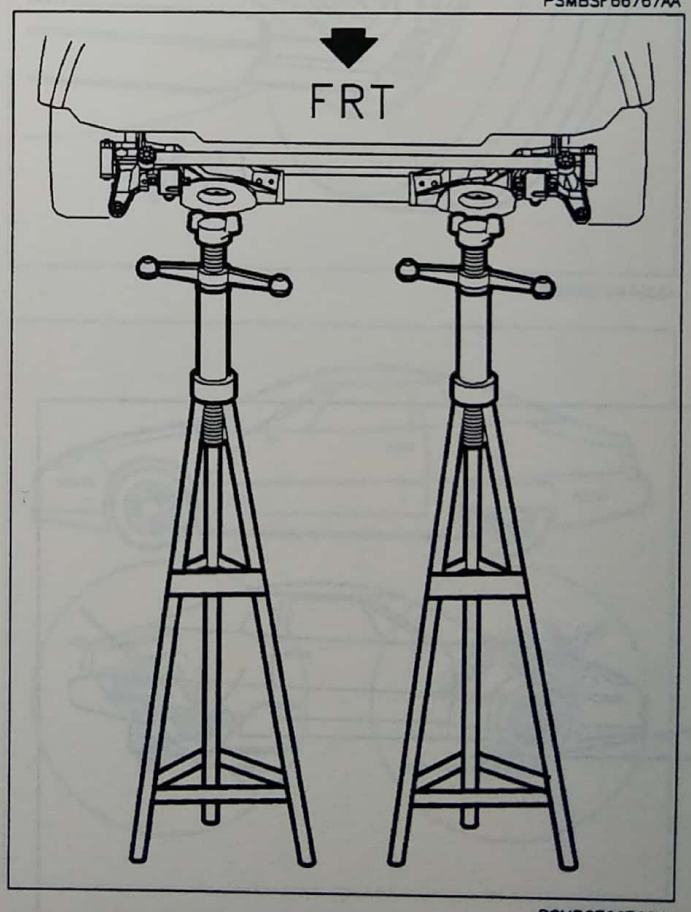

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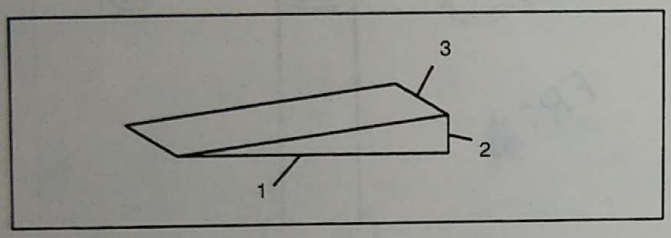
HOISTING/LIFTING FOR A 2 POST INGROUND HOIST - (FRONT AND REAR)

CAUTION: BEFORE ENTERING THE AREA UNDER A RAISED VEHICLE ALWAYS CHECK TO MAKE SURE HOIST SAFETY MECHANISMS ARE ENGAGED OR LIFT SAFETY STANDS ARE IN PLACE.

NOTICE: When using an in ground hoist it is necessary to pay close attention to the ground clearance at the front end of the vehicle. Be careful not to damage any of the front end components.

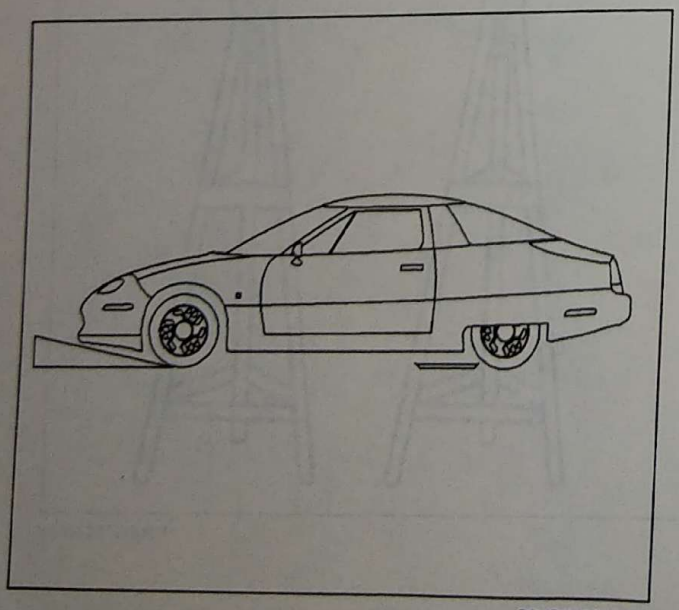
NOTICE: The aid of a ramp for some models of lifts is helpful for obtaining clearance under the front end of the vehicle. Proper clearance will keep the fascia and underbody components from being damaged when approaching or leaving the hoisting area. Ramp size needed:



1. **1050 mm in length (41-3/8 in.)**
2. **155 mm in width (6-7/64 in.)**
3. **230 mm in height (9-1/16 in.)**

NOTICE: With the use of ramps, always have a partner who will be outside and in front of the vehicle guide and watch to ensure that proper alignment is achieved to the ramps and hoisting area. Be careful that you don't drive over or slip off the edge of the ramps. Failure to do so could result in damage to under body and mechanical components.

NOTICE: The first vehicle to be lifted using the ramp method may take several attempts to get properly aligned to the hoist pads under the front of the body structure. Marking the floor with tape, paint or permanent marker after the ramp position is determined will aid in the positioning ramps for future EV1 vehicle lifting.



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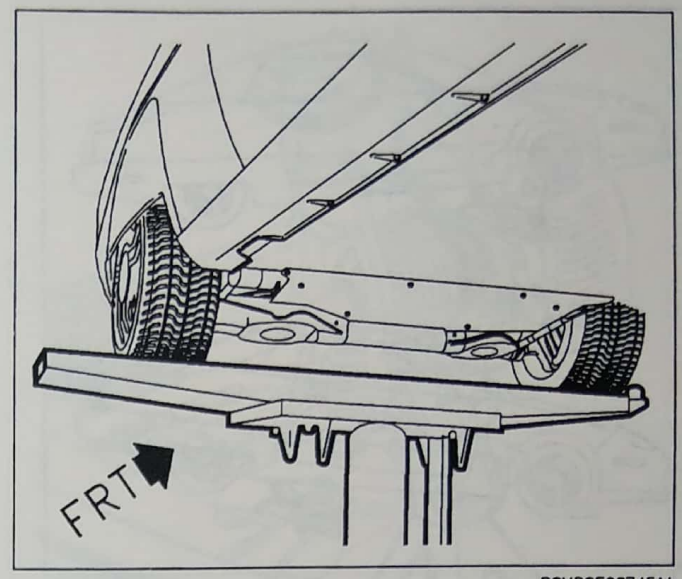
1. Drive the vehicle up to the hoisting area, centering the vehicle to the hoist in its side to side position.
2. Drive vehicle forward until the front of the rear tires contact the rear edge of the rear tire lift tray.
3. Place the ramps on the floor. In front of the vehicle, center each ramp in front of the front tires.
4. Slide ramps rearward until they touch the front of the front tires, or align ramps to markings on floor made from previous lifting as described in the above **"NOTICE."**

5. Drive forward and up the ramps until the rear tires are centered in the rear tire tray portion of the hoist.



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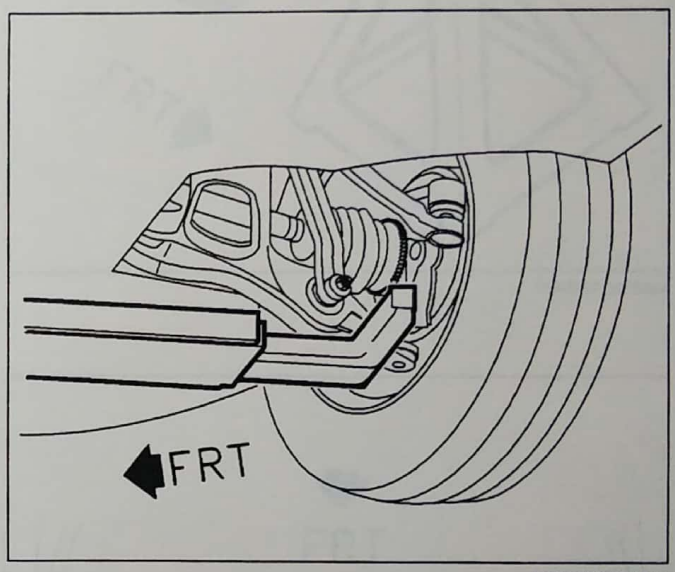
6. Put the front lift pads under the vehicle's front lower control arms at the portion between the ball joint and the yoke.
7. Lift the vehicle to proper working height and position safety stands. (Refer to "Lifting, Jacking, and Support Points" and "Hoisting Lifting with a Floor Jack" sections in this section.)



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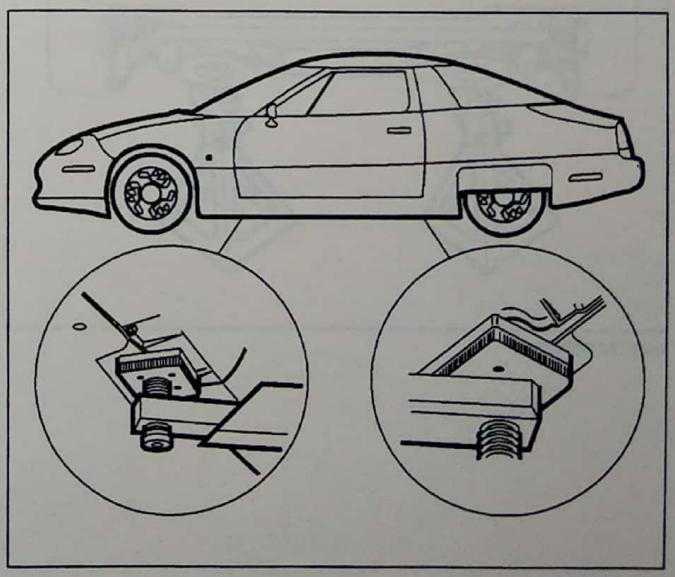
LIFTING WITH A FLOOR JACK.

NOTICE: Do not put floor jack under any portion of the vehicle other than locations shown or damage to the structure may occur.

1. Locate the rocker panel pinch weld flange lift/hoist areas, place floor jack in position, seat the lift pad in place, and chock the wheels. (Refer to "General Information" in the "Lifting, Jacking, and Support Points" section in this section.)



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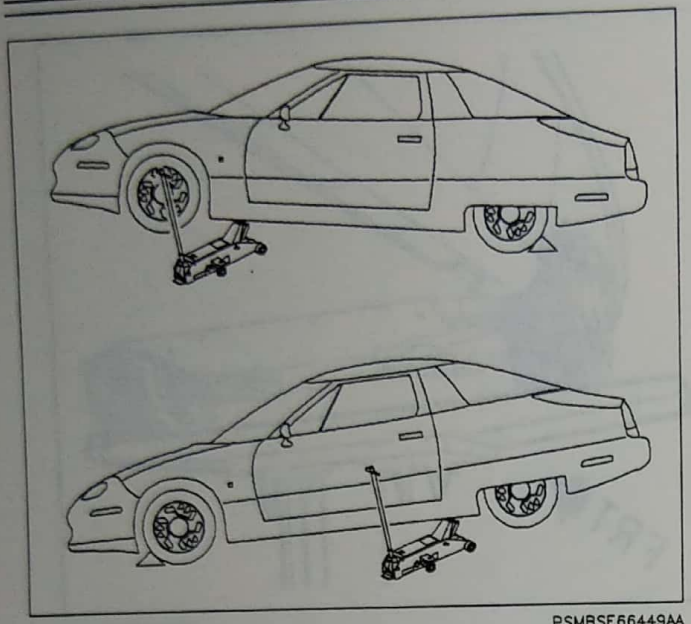

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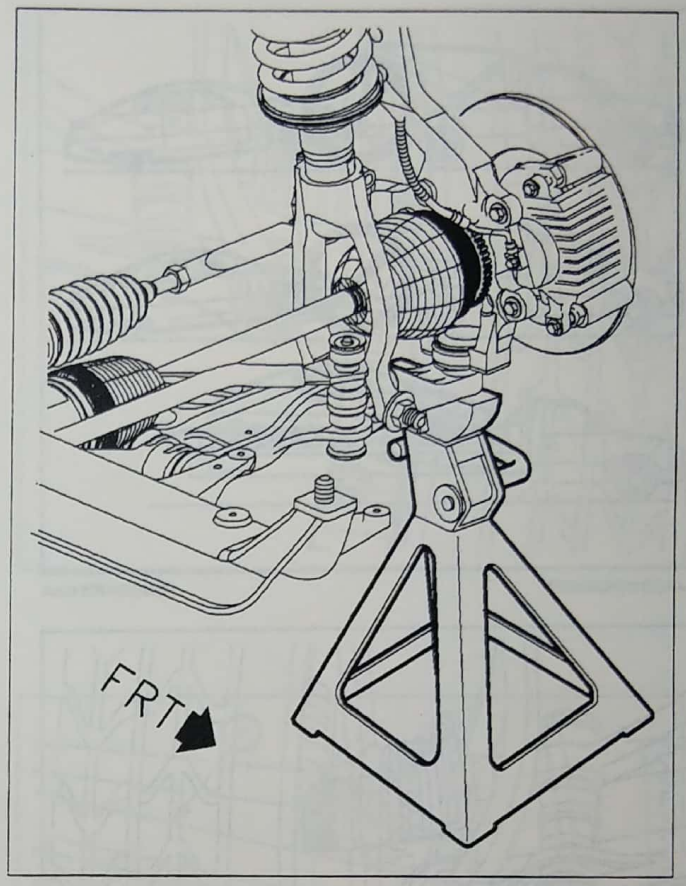
CAUTION: TO HELP AVOID PERSONAL INJURY, ALWAYS USE JACK STANDS WHEN WORKING ON OR UNDER ANY VEHICLE THAT IS SUPPORTED ONLY BY A FLOOR JACK OR A HOIST.

2. Lift vehicle with floor jack.

3. Once the vehicle is at the required working height install safety stands.



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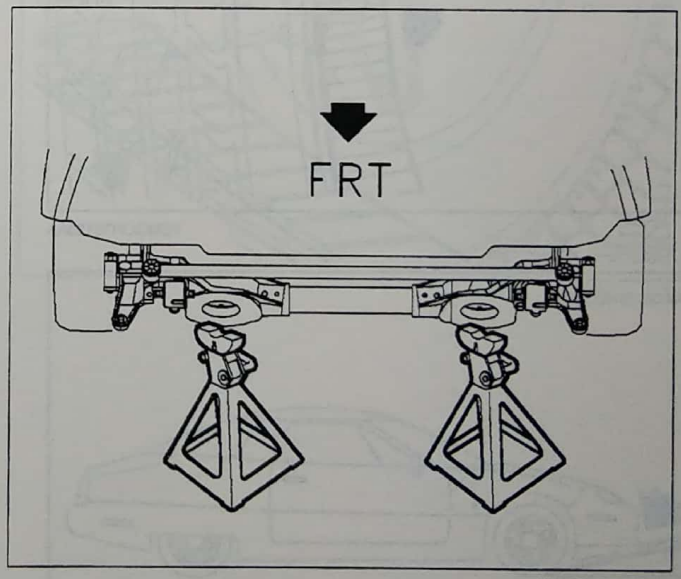

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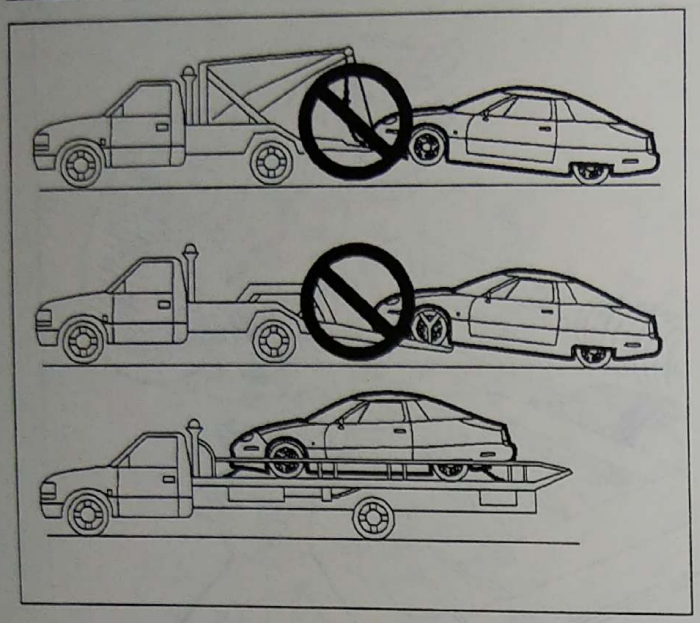

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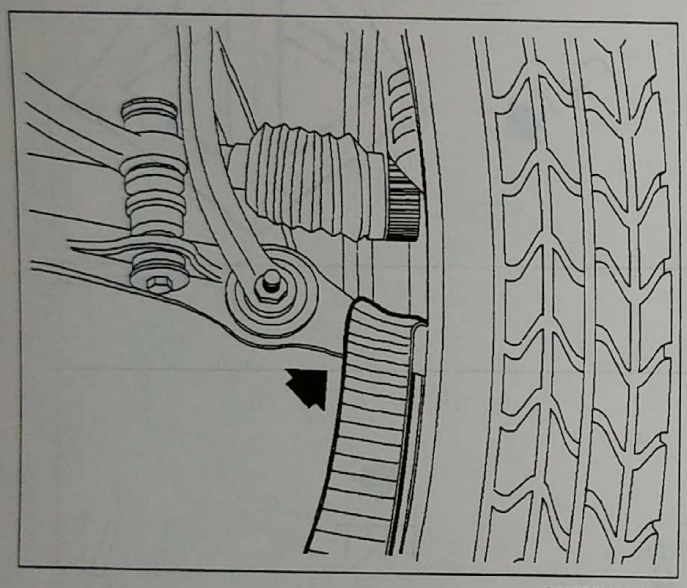
EV1 CAR CARRIER LOADING PROCEDURE

LOADING VEHICLE FRONT TOW

NOTICE: Do not tow with sling−type or wheel−lift equipment or fascia bumper valance damage will occur. Use car−carrier equipment only. Additional ramping may be required. Use four nylon tie−down straps. Do not attach winch cables, chains, J−hooks, T−hooks, or R−hooks to suspension components when using car carrier equipment. Always use nylon straps.



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1. Wrap nylon straps around lower control arms (both sides), between yoke attachment and lower ball joint (same location points as tie−down).

IMPORTANT: Turning front wheels outboard will aid in gaining access to lower control arms.

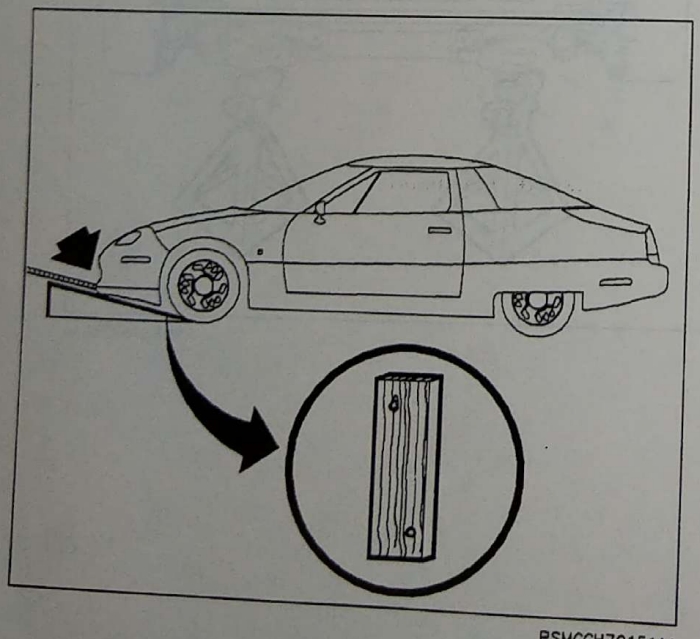
2. Connect winch cable to both nylon straps.
3. Steering wheel must be clamped in a straight−ahead position.
4. Enter Run/Lock Shifter Assembly (RSA) keycode, then push "**RUN**" button. Depress brake pedal, and place shifter lever in the "**N**" (Neutral) position. This procedure will release the park brake. Once shifter lever is in "**N**," place keypad in "**OFF**" mode.

IMPORTANT: To release parking brake with keypad in "**LOCK**" mode and shift lever in "**P**" park.

   a. Depress brake pedal.

   b. While brake pedal is depressed, push park brake apply/release button (located on left side of instrument panel).

NOTICE: To help avoid damaging front fascia, place floor mat, piece of carpeting, etc. between lower portion of front fascia and winch cable.



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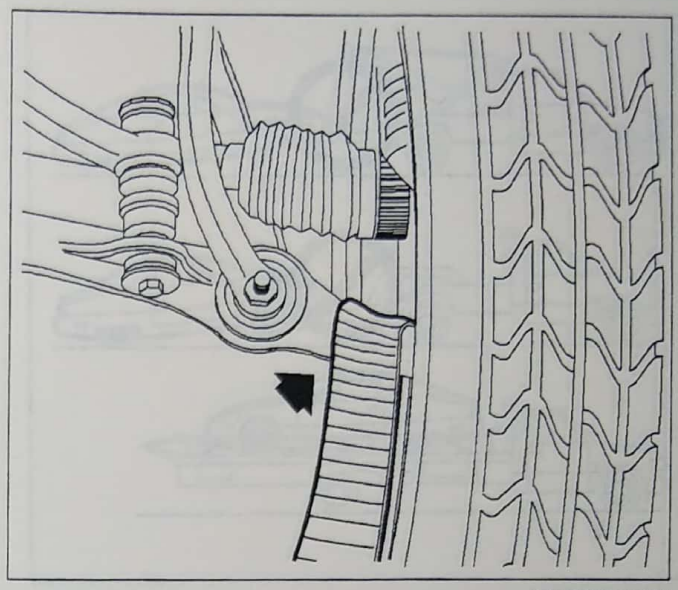
NOTICE: Additional ramping or a 4 X 4 wood beam may be required to load an EV1 onto a car carrier if the angle of the ground the vehicle rests on or the ramp angle of the car carrier is too steep. Use of ramps and/or 4 x 4 wood beam will help avoid damaging front fascia.

5. Winch vehicle onto car carrier.

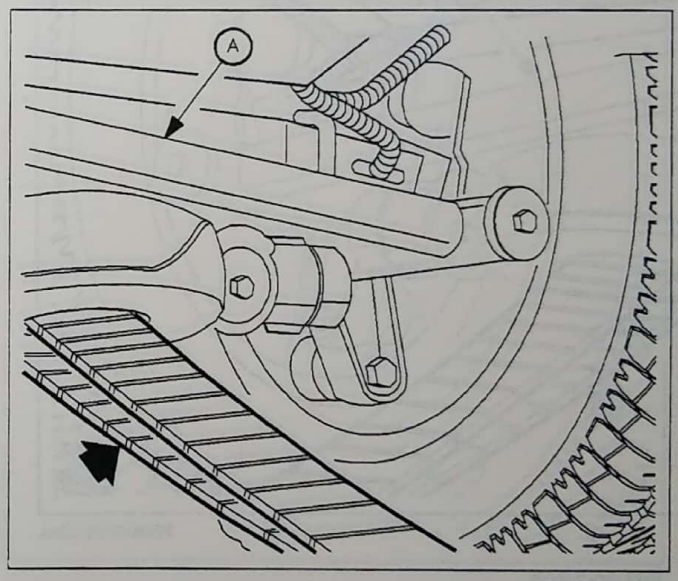
NOTICE: A separate safety strap must be used on each side of the vehicle. Be sure to follow the detailed instruction provided by the tow equipment manufacturer.

6. Once vehicle has been loaded on car carrier, place shift lever in "**P**" (Park) and keypad in "**LOCK**" mode. Park brake will be applied automatically.
7. Tie–down vehicle.
   a. Front tie–down, see step 1.
   b. Rear tie–down, route two (one per side) nylon straps up through the spring mount holes at the rear axle (both sides), then forward through the ***LOWEST*** coil spring opening and back around the bottom of axle.



PSMGCH70150AA

NOTICE: The rear suspension track bar (A) will be damaged if used as an attachment point. Do not route the nylon strap around the rear suspension track bar.



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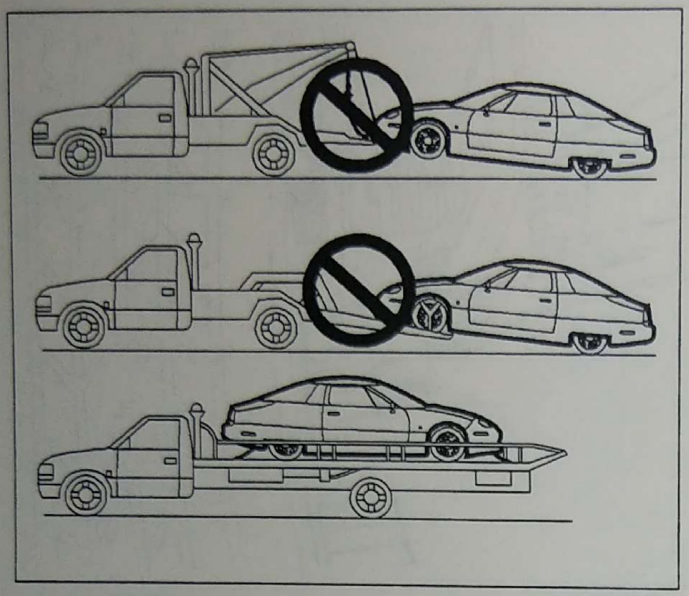
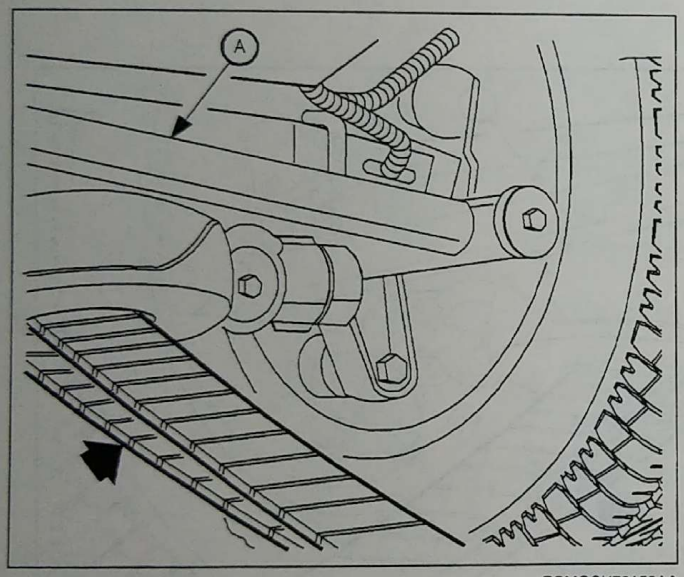


PSMGCH70152AA

LOADING VEHICLE REAR TOW

NOTICE: Do not tow with sling–type or wheel–lift equipment or fascia bumper valance damage will occur. Use car–carrier equipment only. Additional ramping may be required. Use four nylon tie–down straps. Do not attach winch cables, chains, J–hooks, T–hooks, or R–hooks to suspension components when using car carrier equipment. Always use nylon straps.

1. Route two (one per side) nylon straps up through the spring mount holes at the rear axle (both sides), then forward through the ***LOWEST*** coil spring opening and back around the bottom of axle (same location as tie–down points).



PSMGCH70153AA

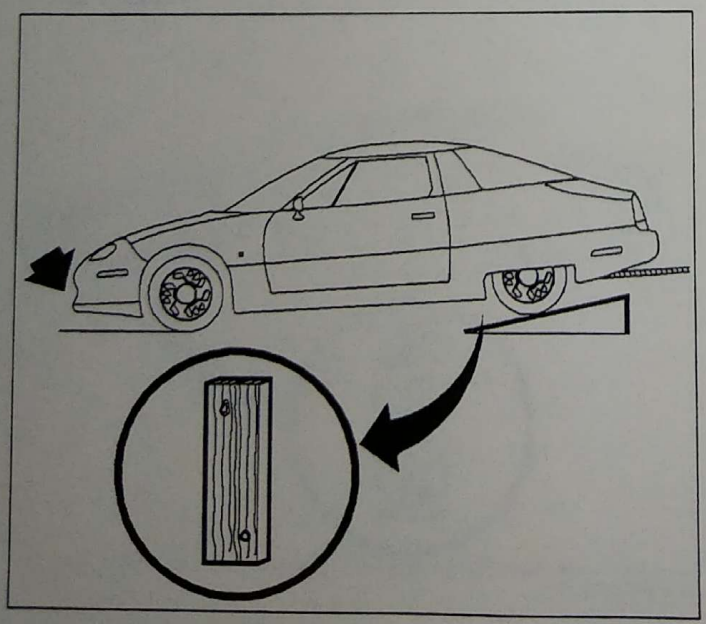
NOTICE: The rear suspension track bar (A) will be damaged if used as a attachment point. Do not route the nylon strap around the rear suspension track bar.

2. Connect winch cable to both nylon straps.
3. Steering wheel must be clamped in a straight–ahead position.
4. Enter Run/Lock Shifter Assembly (RSA) keycode, then push "**RUN**" button. Depress brake pedal, and place shifter lever in the "**N**" (Neutral) position. This procedure will release the park brake. Once shifter lever is in "**N**," place keypad in "**OFF**" mode.

IMPORTANT: To release parking brake with keypad in "**LOCK**" mode and shift lever in "**P**" park.

a. Depress brake pedal.

b. While brake pedal is depressed, push park brake apply/release button (located on left side of instrument panel).



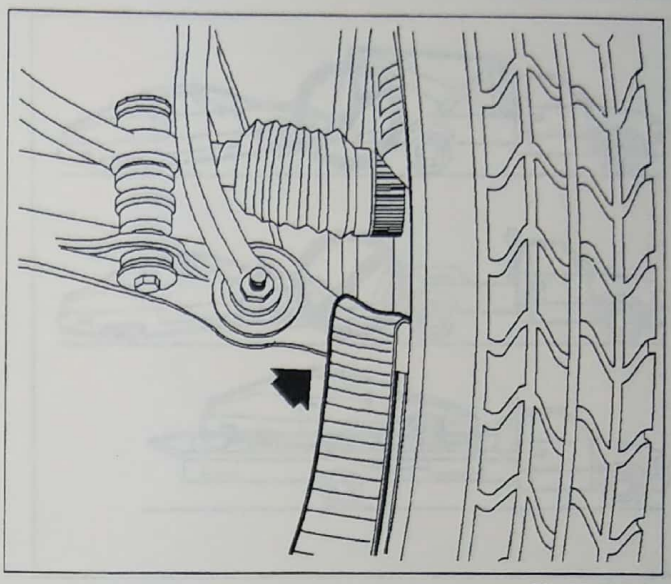
PSMGCH70154AA

NOTICE: Additional ramping or a 4 X 4 wood beam may be required to load an EV1 onto a car carrier if the angle of the ground the vehicle rests on or the ramp angle of the car carrier is too steep. Use of ramps and/or 4 x 4 wood beam will help avoid damaging front fascia.

5. Winch vehicle onto car carrier.

NOTICE: A separate safety strap must be used on each side of the vehicle. Be sure to follow the detailed instruction provided by the tow equipment manufacturer.

6. Once vehicle has been loaded on car carrier, place shift lever in "**P**" (Park) and keypad in "**LOCK**" mode. Park brake will be applied automatically.
7. Tie–down vehicle.
   a. Rear tie–down, see step 1.
   b. Front tie–down, wrap nylon straps around lower control arms (both sides), between yoke attachment and lower ball joint.



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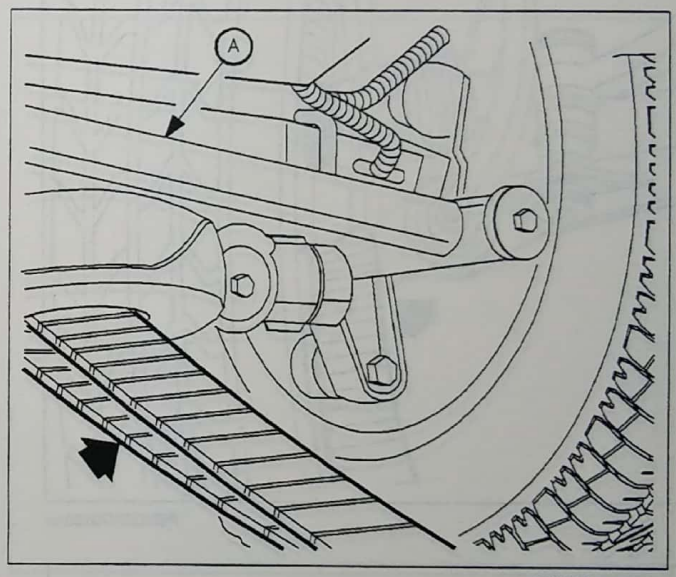

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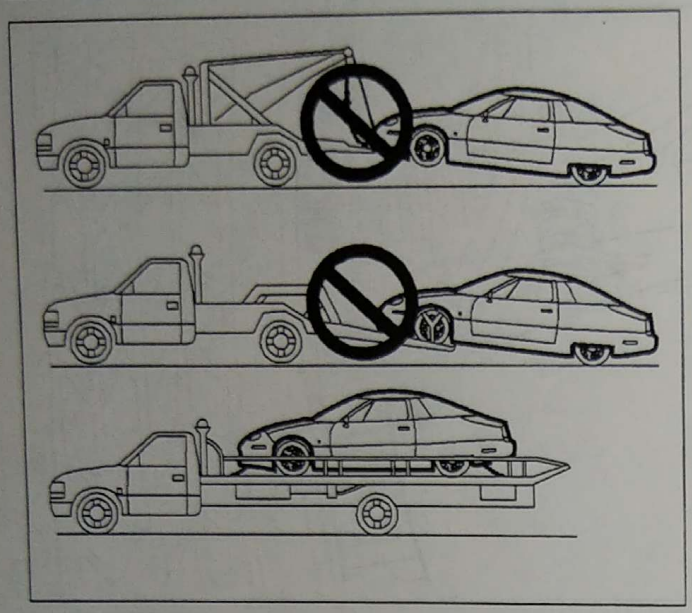
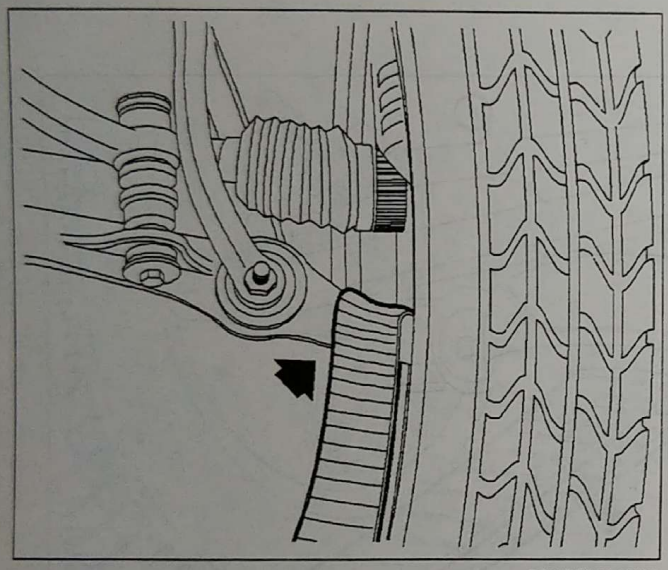


PSMGCH70149AA

LOADING VEHICLE FRONT TOW W/FLAT FRONT OR REAR TIRE (LEFT OR RIGHT)

NOTICE: Do not tow with sling–type or wheel–lift equipment or fascia bumper valance damage will occur. Use car–carrier equipment only. Additional ramping may be required. Use four nylon tie–down straps. Do not attach winch cables, chains, J–hooks, T–hooks, or R–hooks to suspension components when using car carrier equipment. Always use nylon straps.



PSMGCH70150AA

1. Wrap nylon straps around lower control arms (both sides), between yoke attachment and lower ball joint (same location points as tie–down).

IMPORTANT: Turning front wheels outboard will aid in gaining access to lower control arms.

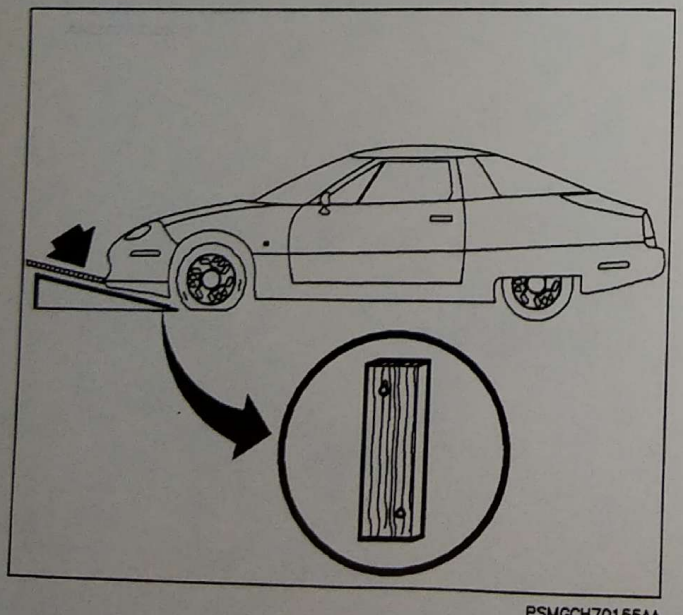
2. Connect winch cable to both nylon straps.
3. Steering wheel must be clamped in a straight–ahead position.
4. Enter Run/Lock Shifter Assembly (RSA) keycode, then push "**RUN**" button. Depress brake pedal, and place shifter lever in the "**N**" (Neutral) position. This procedure will release the park brake. Once shifter lever is in "**N,**" place keypad in "**OFF**" mode.

IMPORTANT: To release parking brake with keypad in "**LOCK**" mode and shift lever in "**P**" park.

a. Depress brake pedal.

b. While brake pedal is depressed, push park brake apply/release button (located on left side of instrument panel).

NOTICE: To help avoid damaging front fascia, place floor mat, piece of carpeting, etc. between lower portion of front fascia and winch cable.



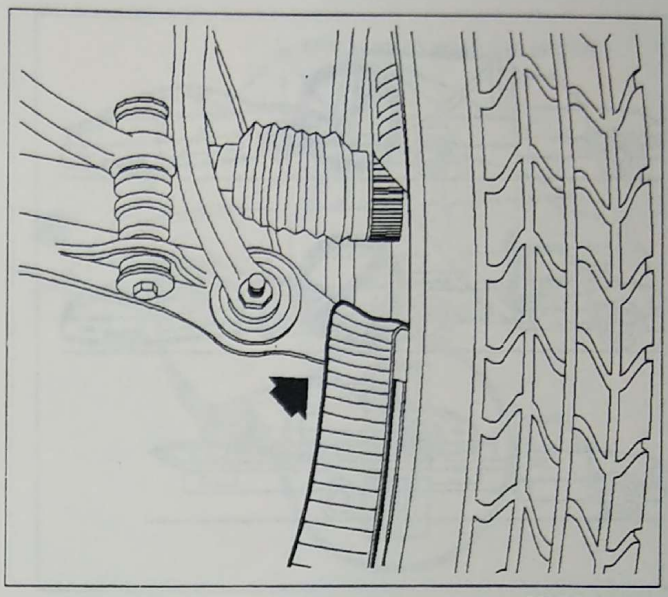
PSMGCH70155AA

NOTICE: Additional ramping or a 4 X 4 wood beam may be required to load an EV1 onto a car carrier if the angle of the ground the vehicle rests on or the ramp angle of the car carrier is too steep. Use of ramps and/or 4 x 4 wood beam will help avoid damaging front fascia.

5. Winch vehicle onto car carrier.

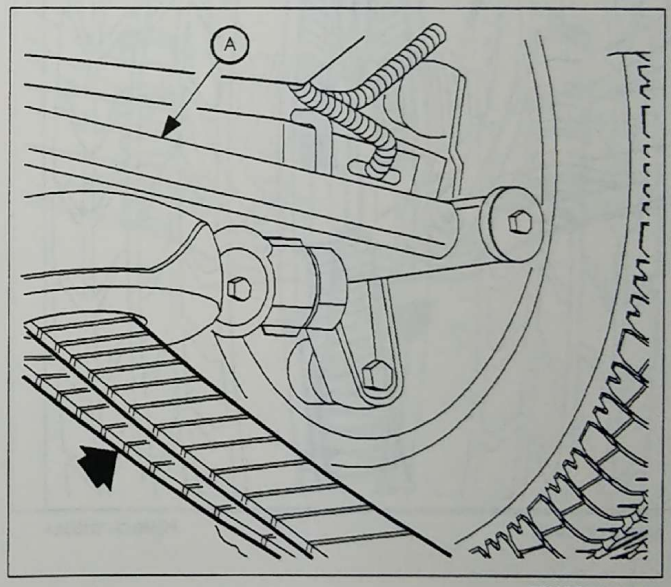
NOTICE: A separate safety strap must be used on each side of the vehicle. Be sure to follow the detailed instruction provided by the tow equipment manufacturer.

6. Once vehicle has been loaded on car carrier, place shift lever in "**P**" (Park) and keypad in "**LOCK**" mode. Park brake will be applied automatically.
7. Tie–down vehicle.
   a. Front tie–down, see step 1.
   b. Rear tie–down, route two (one per side) nylon straps up through the spring mount holes at the rear axle (both sides), then forward through the ***LOWEST*** coil spring opening and back around the bottom of axle.



PSMGCH70150AA

NOTICE: The rear suspension track bar (A) will be damaged if used as a attachment point. Do not route the nylon strap around the rear suspension track bar.



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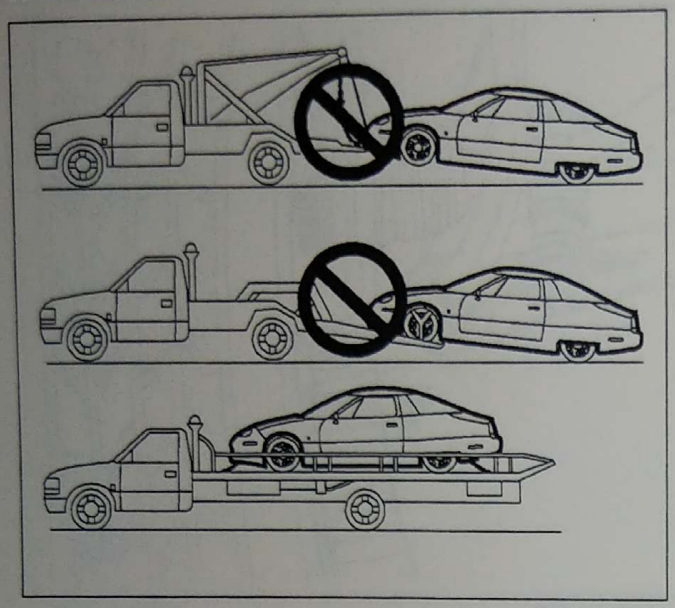

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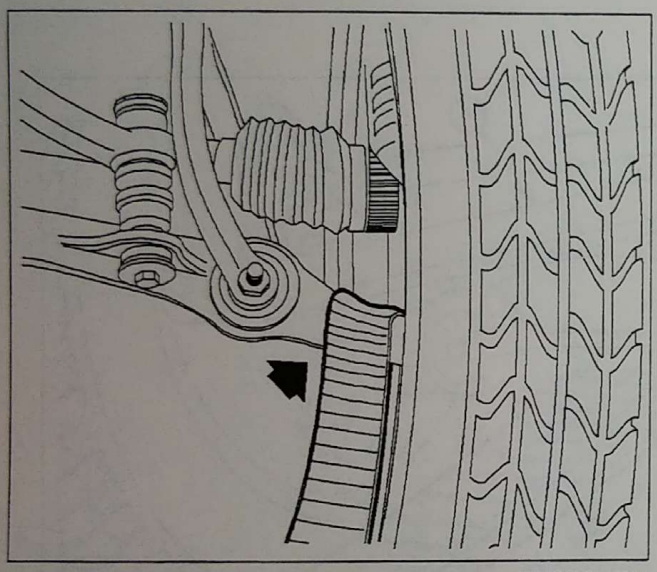

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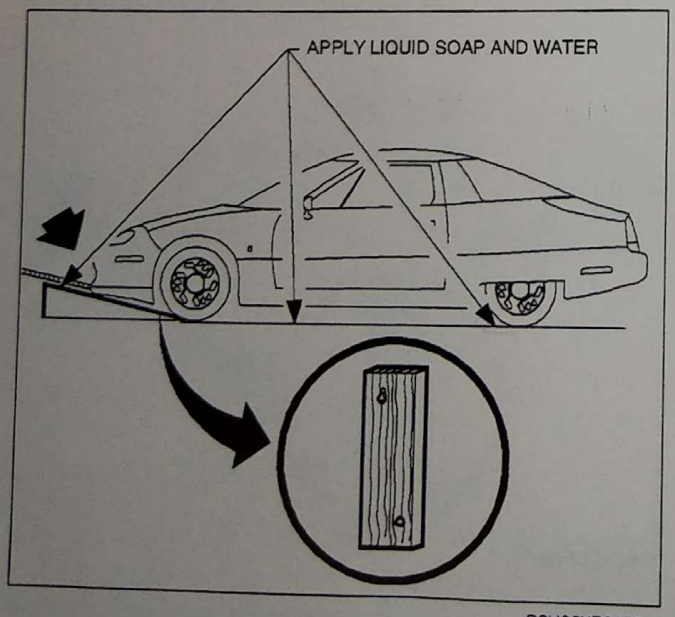


PSMGCH70156AA

LOADING VEHICLE FRONT TOW W/NO 12–VOLT AUXILIARY BATTERY POWER. SHIFTER IN "P" (PARK), PARKING BRAKE APPLIED.

NOTICE: Do not tow with sling–type or wheel–lift equipment or fascia bumper valance damage will occur. Use car–carrier equipment only. Additional ramping may be required. Use four nylon tie–down straps. Do not attach winch cables, chains, J–hooks, T–hooks, or R–hooks to suspension components when using car carrier equipment. Always use nylon straps.

1. Perform Battery Recovery procedure.
   a. Momentarily press and release the battery recovery button (located under instrument panel on passenger's side of car).
   b. Wait 30 seconds.
   c. Press and hold the battery recovery button for three seconds, then release the button.
   d. Enter Run/Lock Shifter Assembly (RSA) keycode and push the "**RUN**" button.

If voltage is restored, depress brake pedal and place shifter lever in the "**N**" (Neutral) position. Park brake will be automatically released. Once shifter lever is in "**N**", place keypad in "**OFF**" mode (refer to "LOADING VEHICLE FRONT TOW"). If voltage is **NOT** restored, proceed to step 2.

2. Wrap nylon straps around lower control arms (both sides), between yoke attachment and lower ball joint (same location points as tie–down).

IMPORTANT: Turning front wheels outboard will aid in gaining access to lower control arms.

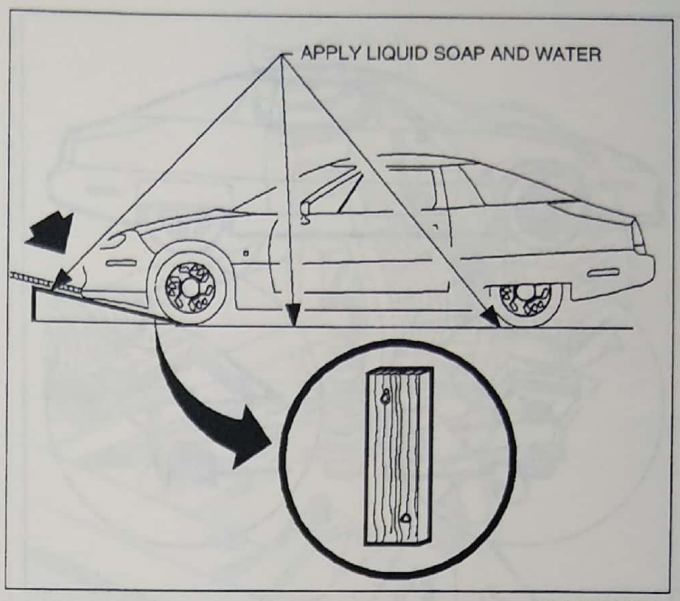
3. Connect winch cable to both nylon straps.
4. Steering wheel must be clamped in a straight–ahead position.
5. Apply liquid soap and water solution to pavement and car carrier bed (see illustration).

NOTICE: To help avoid damaging front fascia, place floor mat, piece of carpeting, etc. between lower portion of front fascia and winch cable.

NOTICE: Additional ramping or a 4 X 4 wood beam may be required to load an EV1 onto a car carrier if the angle of the ground the vehicle rests on or the ramp angle of the car carrier is too steep. Use of ramps and/or 4 x 4 wood beam will help avoid damaging front fascia.

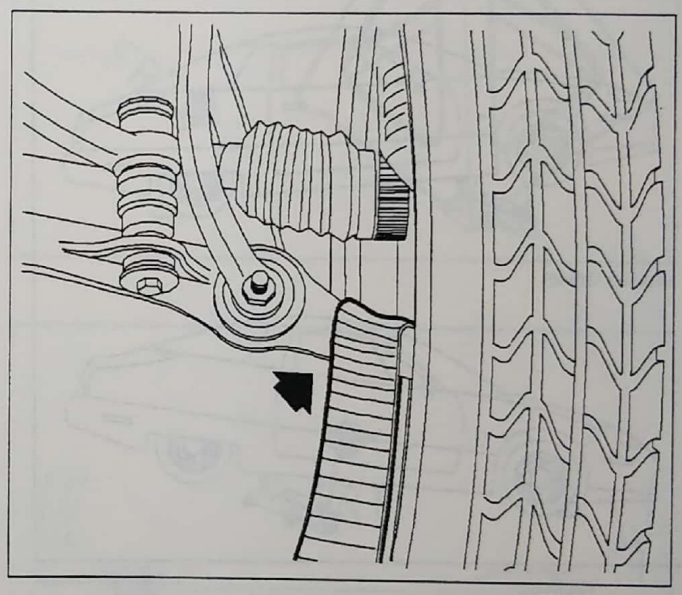
6. Winch vehicle onto car carrier.

NOTICE: A separate safety strap must be used on each side of the vehicle. Be sure to follow the detailed instruction provided by the tow equipment manufacturer.



PSMGCH70156AA

7. Tie–down vehicle.
   a. Front tie–down, see step 2.
   b. Rear tie–down, route two (one per side) nylon straps up through the spring mount holes at the rear axle (both sides), then forward through the ***LOWEST*** coil spring opening and back around the bottom of axle.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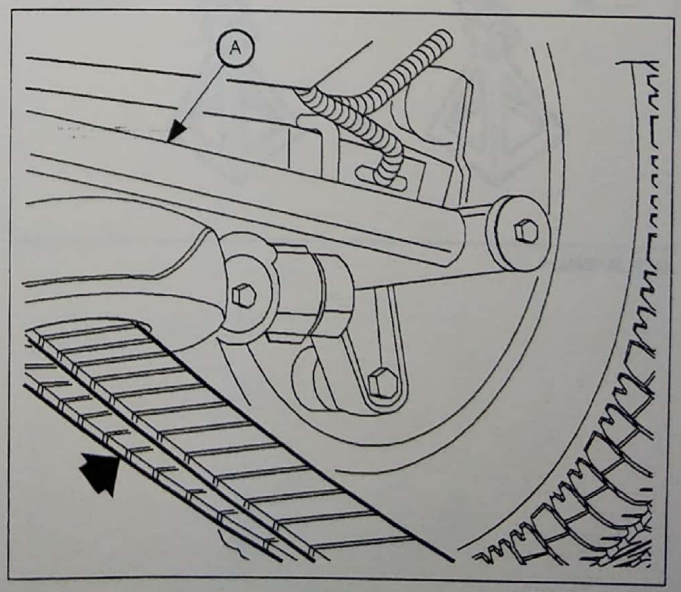
NOTICE: The rear suspension track bar (A) will be damaged if used as an attachment point. Do not route the nylon strap around the rear suspension track bar.



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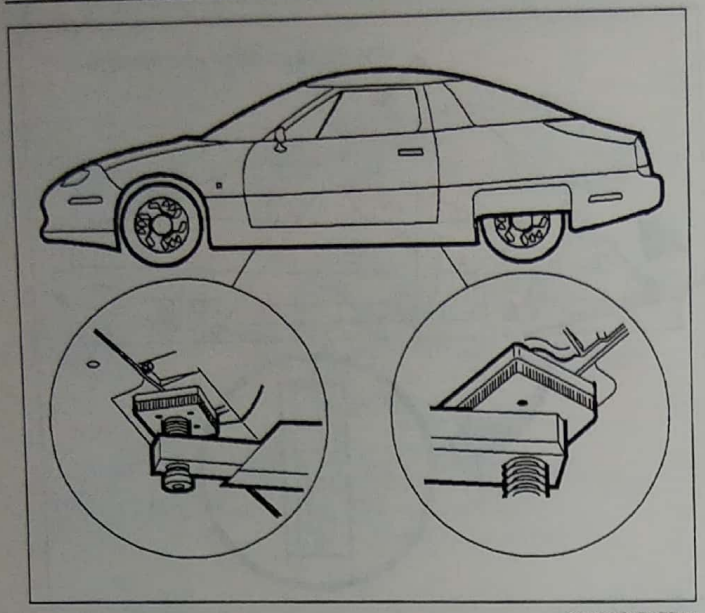

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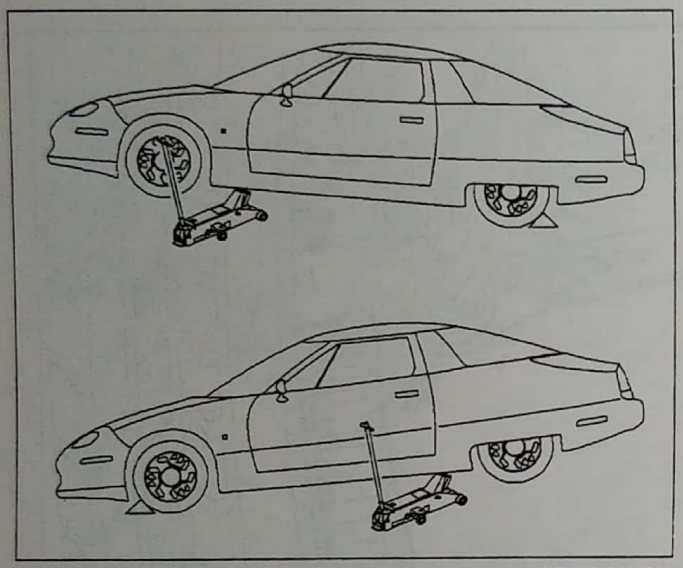


PSMBSF66449AA

EV1 LIFTING PROCEDURE USING A FLOOR JACK

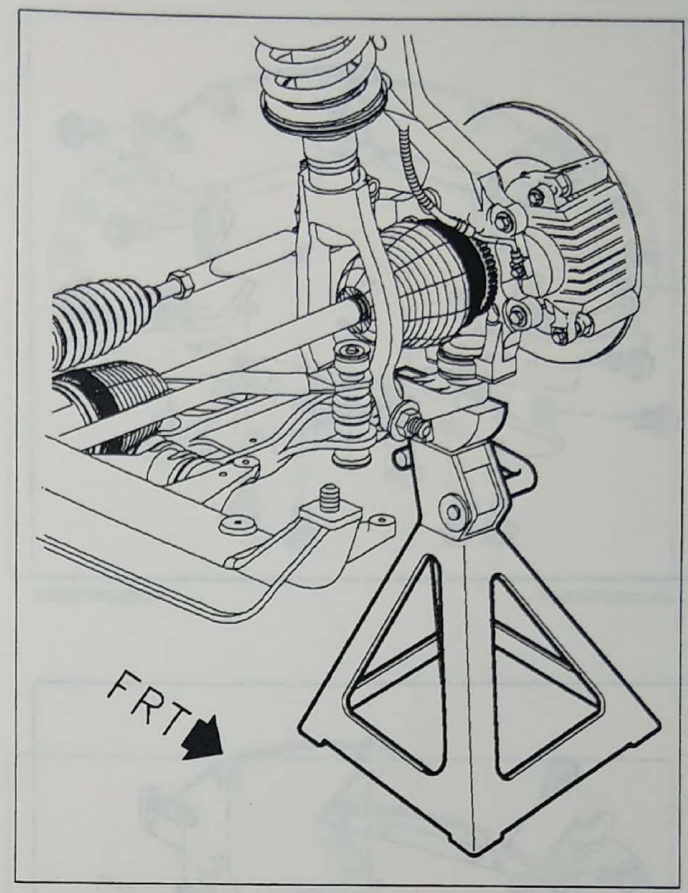
NOTICE: Do not put floor jack under any portion of the vehicle other than locations shown or damage to the structure may occur.

1. Locate the rocker panel pinch weld flange/hoist areas, place floor jack in position, seat the lift pad in place, and chock the wheels.

CAUTION: TO HELP A VOID PERSONAL INJURY, ALWAYS USE JACKS STANDS WHEN WORKING ON OR UNDER ANY VEHICLE THAT IS SUPPORTED ONLY BY A FLOOR JACK OR A HOIST.

2. Lift vehicle with jack.

3. Once the vehicle is at the required working height, install safety stands.



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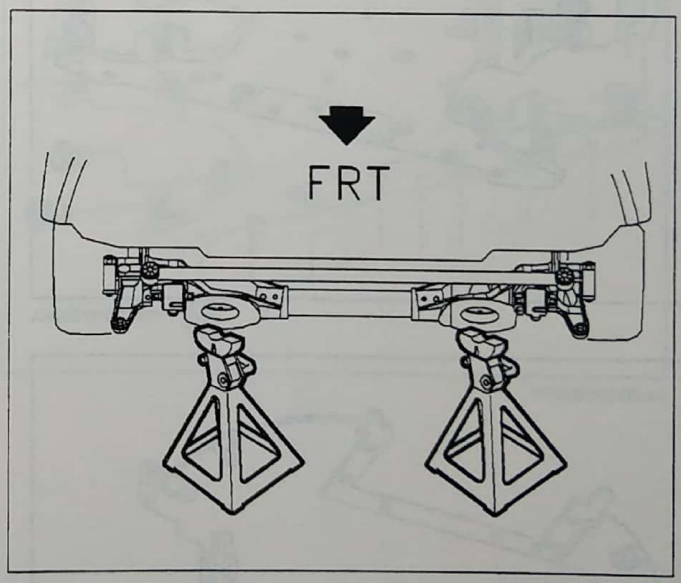

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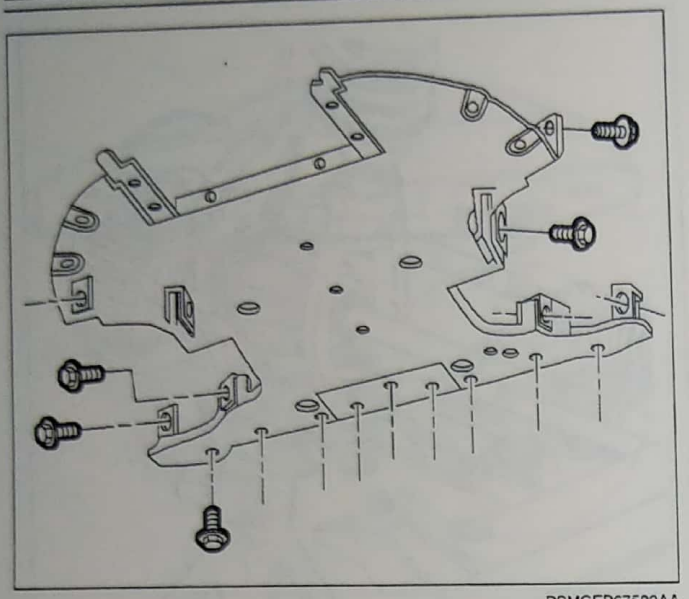
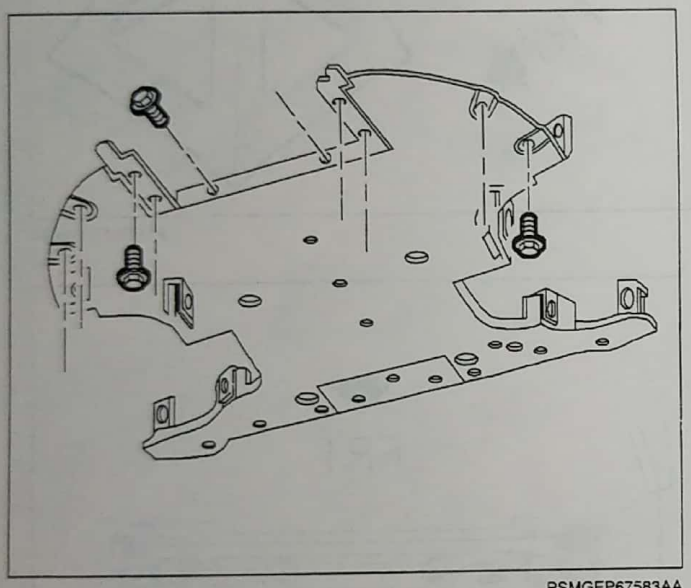
UNDERBODY FRONT AIR DEFLECTOR



PSMGEP67582AA

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual).
2. Remove bolts retaining underbody front air deflector to underbody center air deflectors.
3. Remove bolts retaining underbody front air deflector to front wheelhouse panel liners.



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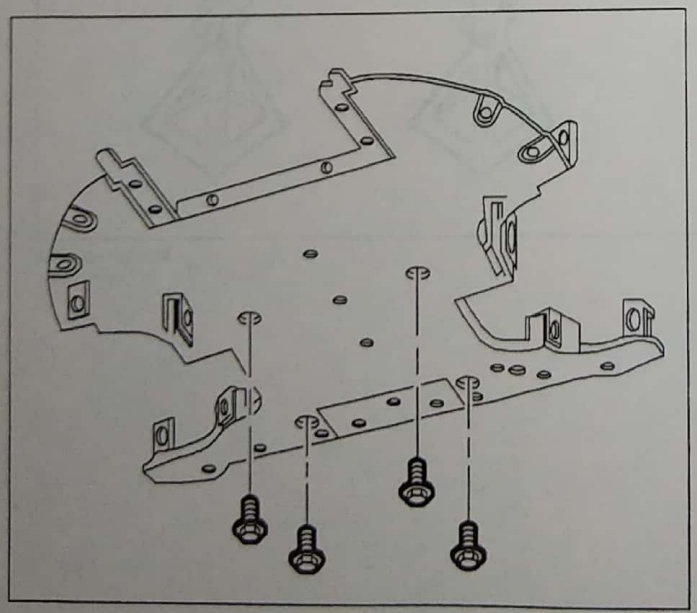
4. Remove bolts retaining underbody front air deflector to front bumper fascia assembly.
5. Remove bolts retaining underbody front air deflector to condenser radiator fan module (CRFM) bracket.
6. Remove bolts retaining underbody front air deflector to side baffles.



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7. Remove bolts retaining underbody front air deflector to drivetrain and front suspension crossmember assembly.
8. Lower underbody front air deflector and disengage tabs from front bumper fascia assembly.

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INSTALLATION

IMPORTANT: If bolt threads or "J" nuts threads are damaged during removal or installation, remove bolt and fastener, inspect, and replace if necessary.

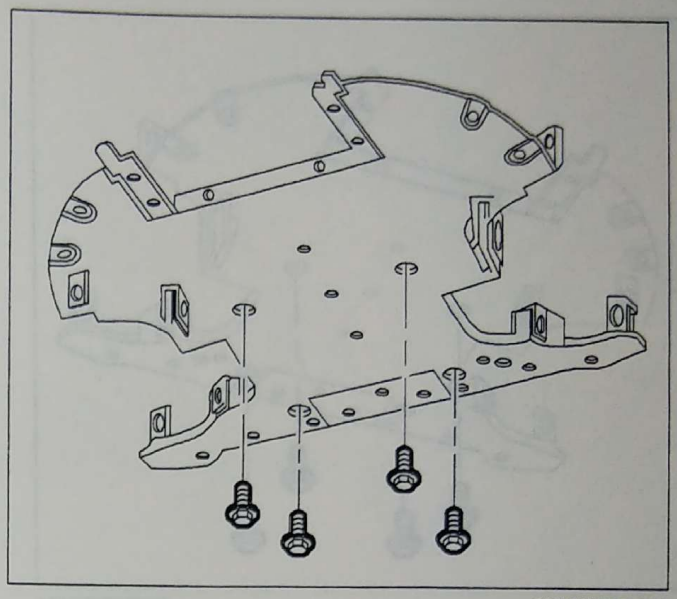
1. Raise front edge of air deflector and engage tabs into retaining slots on front bumper fascia assembly.
2. Raise and support underbody front air deflector to underside of vehicle.

IMPORTANT: Flange on air deflector must be located forward of Condenser Radiator Fan Module (CRFM) bracket.

3. Loosely install bolt retaining air deflector to CRFM bracket.
4. Loosely install bolts retaining underbody front air deflector to front mounting locations of drivetrain and front suspension crossmember assembly.
5. Loosely install bolts retaining underbody front air deflector to rear mounting locations of drivetrain and front suspension crossmember assembly.
6. Install and tighten bolts retaining underbody front air deflector to underbody center air deflectors. Torque as specified.

Torque: 6 N•m (53 in–lbs)

IMPORTANT: If cradle bolt begins to cross thread during installation, stop immediately, remove bolt, then run thread tap (M6.0 mm x 1.0) into insert to repair damaged threads.



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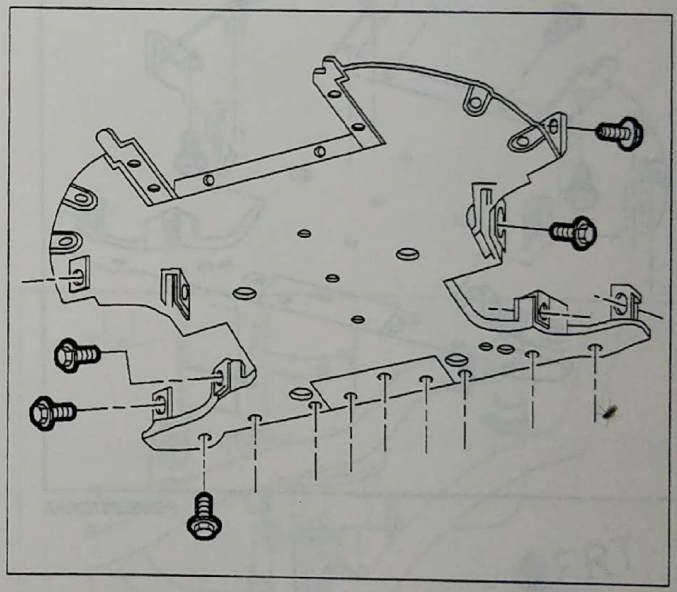

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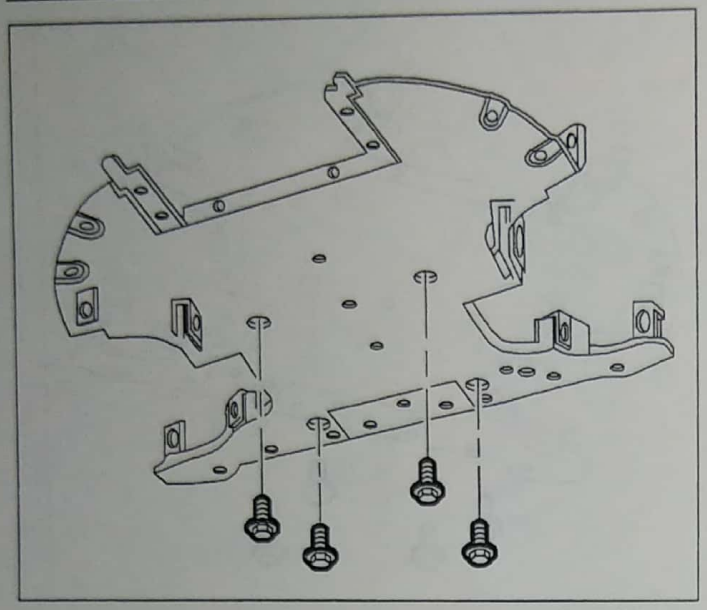

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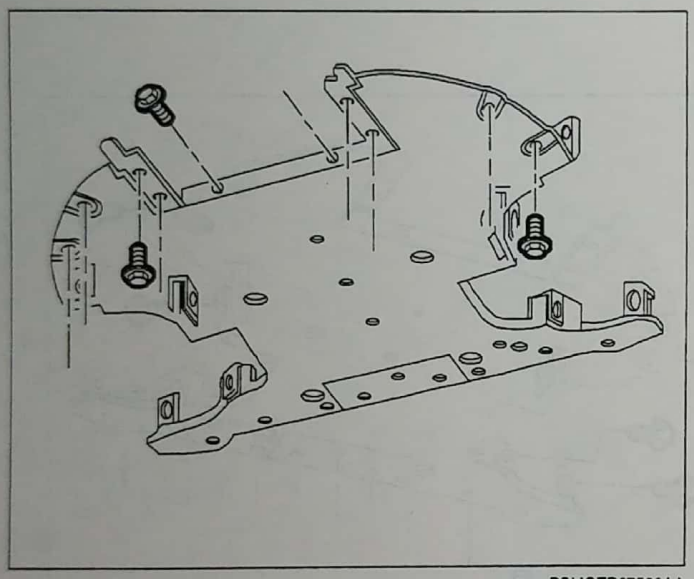
7. Tighten bolts retaining underbody front air deflector to front mounting locations of drivetrain and front suspension crossmember assembly. Torque as specified.

Torque: 6 N•m (53 in–lbs)



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IMPORTANT: At CRFM attachment, position air deflector flange so that it rests up against the bottom of the CRFM lower support.

8. Install and tighten bolt retaining underbody front air deflector to CRFM bracket. Torque as specified.

Torque: 6 N•m (53 in–lbs)

9. Tighten remaining bolt retaining air deflector to CRFM bracket. Ensure underbody front air deflector is up against bottom of CRFM lower support. Torque as specified.

Torque: 6 N•m (53 in–lbs)

10. Install and tighten bolts retaining underbody front air deflector to CRFM to fascia close-out side baffles. Torque as specified.

Torque: 6 N•m (53 in–lbs)

11. Install and tighten bolts retaining underbody front air deflector to front bumper fascia assembly. Torque as specified.

Torque: 6 N•m (53 in–lbs)

12. Install and tighten bolts retaining underbody front air deflector to front wheelhouse panel liner on one side of the vehicle. Front tires may need to be rotated to access mounting locations. Torque as specified.

Torque: 6 N•m (53 in–lbs)

13. Install and tighten bolts retaining underbody front air deflector to front wheelhouse panel liner on opposite side of the vehicle. Front tires may need to be rotated to access mounting locations. Torque as specified.

Torque: 6 N•m (53 in–lbs)

14. Lower vehicle and turn front wheels to face in a straight ahead position.

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POWER ELECTRONICS BAY (PEB)

REMOVAL

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Disable high voltage. (Refer to "High Voltage Disable" in this manual.)
2. Disable 12 volt system. (Refer to "12 Volt System Disable" in this manual.)

IMPORTANT: Do not remove expansion tank cover or open cooling system drains from a hot system. allow system to cool first.

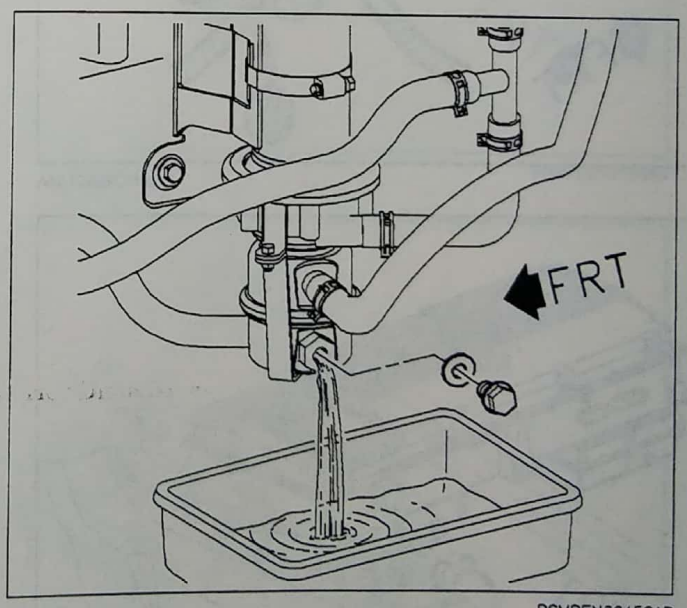
3. Remove the expansion tank cover.
4. Raise the vehicle on a hoist. (Refer to "Lifting, Jacking, and Hoisting" section in this manual.)
5. Remove front underbody air deflector. (Refer to "Front Underbody Air Deflector Removal" procedure in this manual.)
6. Position drain pan under water pump manifold.

IMPORTANT: A two gallon container will be required to hold the coolant.

7. Remove the drain plug and gasket from the water pump manifold allowing the coolant to flow from the main path.
8. After coolant has drained from the main path, reinstall water pump manifold drain plug and gasket.

Torque: 11 N•m (97 in–lbs)

9. Lower vehicle.



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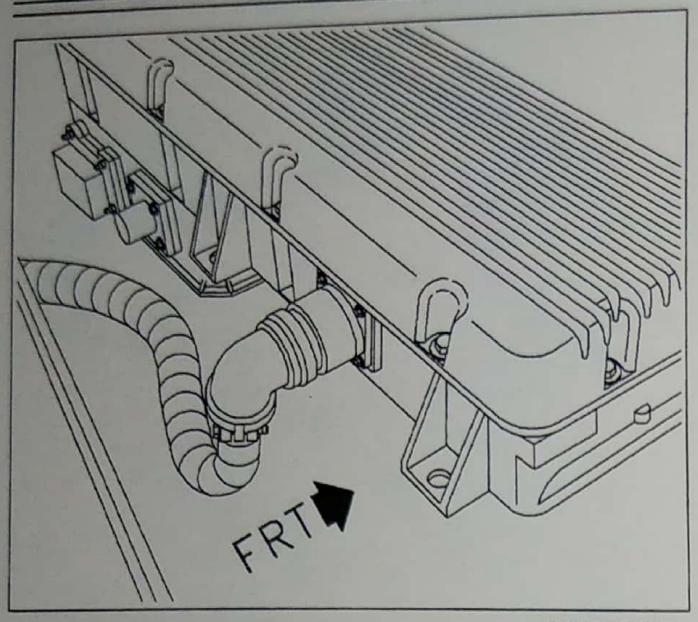
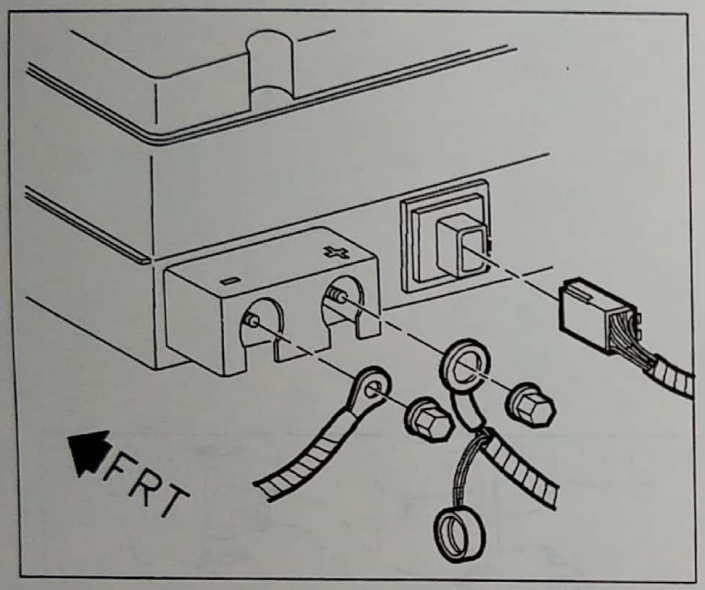


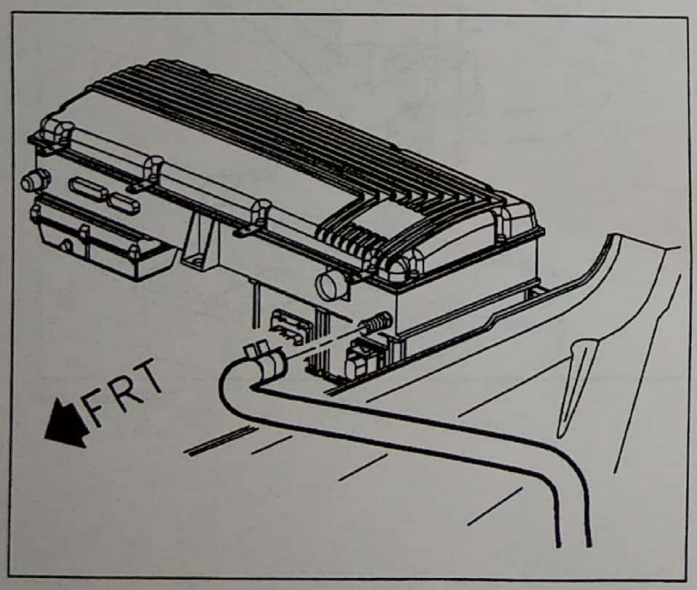
PSMPEN66279AA

10. Disconnect the battery assembly to power inverter module (PIM) cannon connector from the right rear corner of the PEB.



PSMPEN66019AA

11. Disconnect the accessory AC and DC power control module (APM) 5−way connector from the rear of the PIM.
12. Remove the negative and positive battery cables from the PIM. Voltage should not be present at these connections. If voltage is present verify that all steps of low and high voltage disable have been completed.

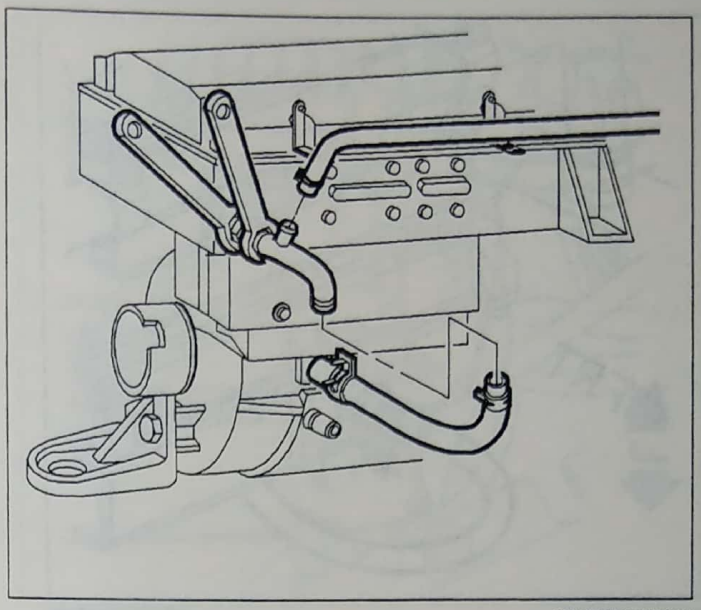


PSMPEN66020AA

13. Disconnect the driver side coolant hose from the PIM.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, fittings or components

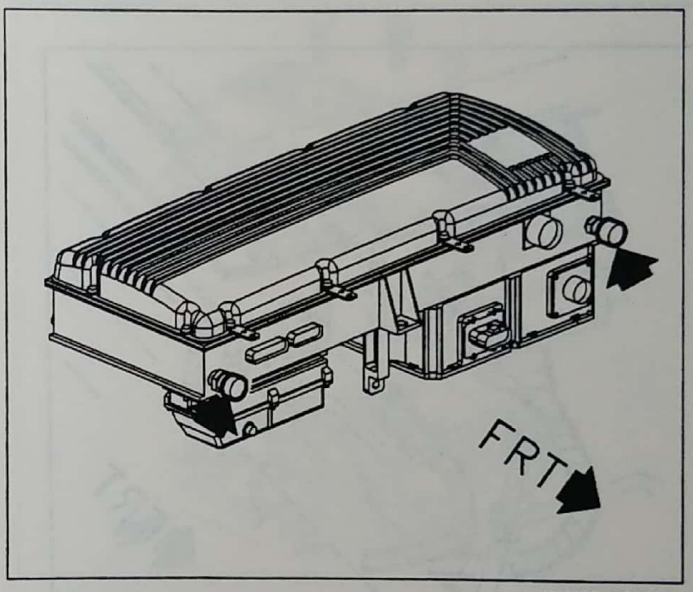
14. Disconnect the passenger side coolant hose from PIM only.



PSMPEN67370AA

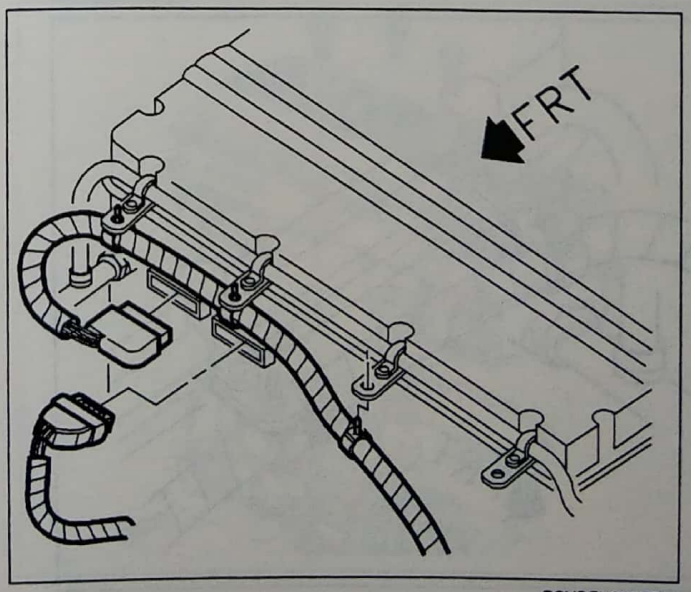
15. Install coolant plugs to prevent coolant leakage during removal.

IMPORTANT: If coolant plugs are not available, tape the cooling fittings.

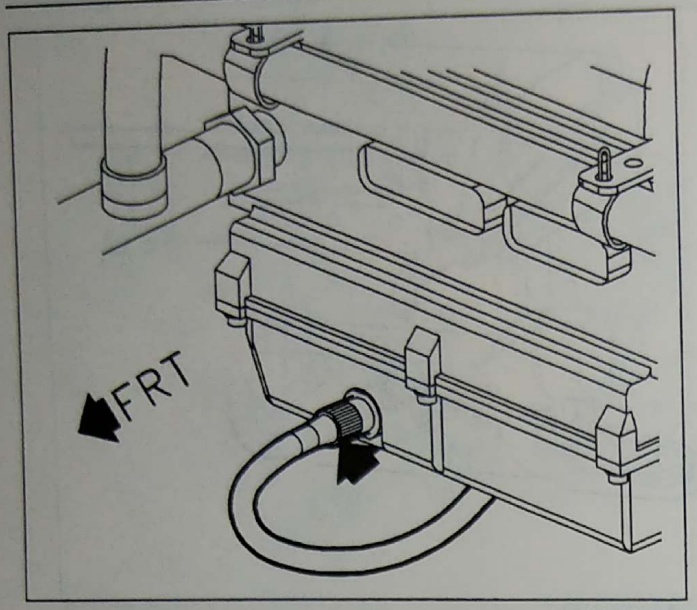


PSMPEN65996AA

16. Remove the 32–way and the 24–way connectors at the forward right corner of the PIM. To remove the connectors squeeze the connector retainer and pull outward.

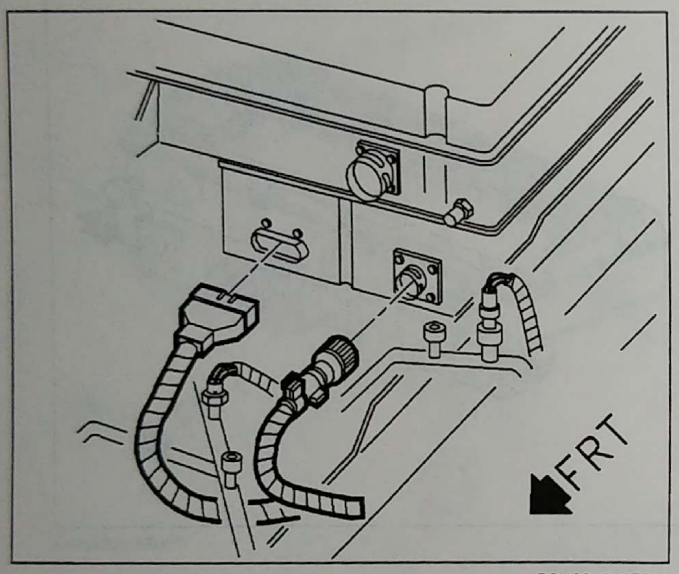


PSMPEN66075AA



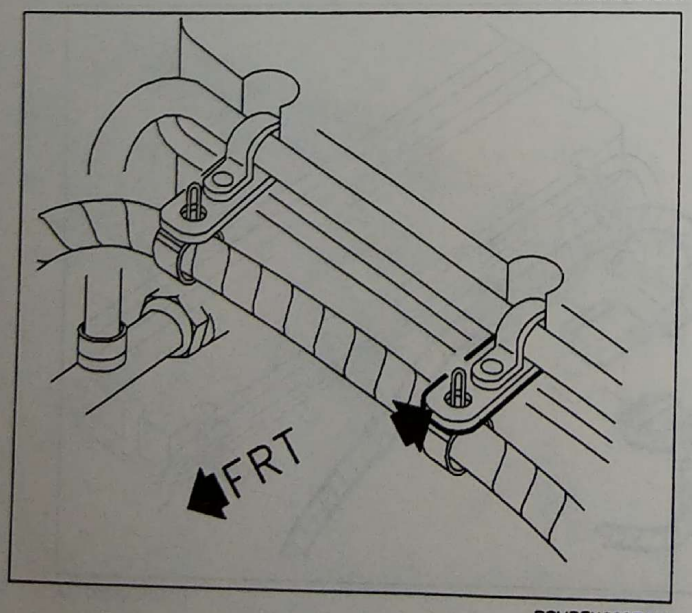
PSMPEN66278AA

17. Disconnect the power steering control module (PSCM) 5−way connector at the PSCM.



PSMGCH66073AA

18. Disconnect the accessory AC and DC power control module (APM) 24−way and small cannon connector at the forward left side of the APM.

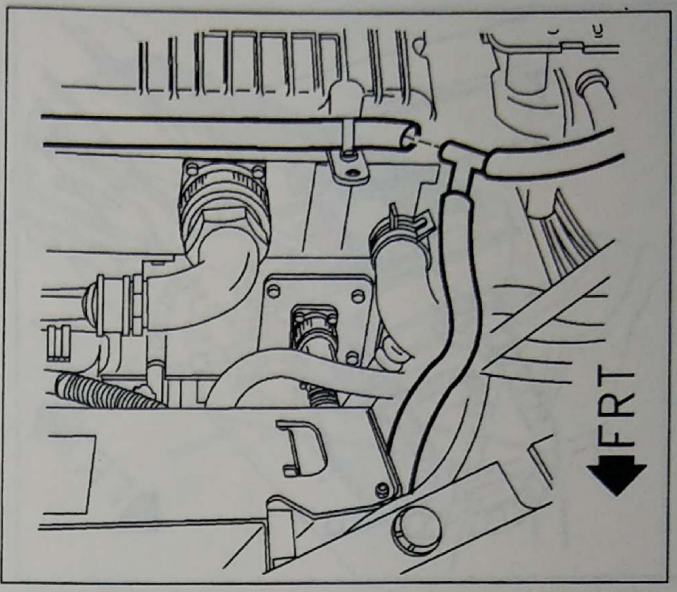


PSMPEN66074AA

IMPORTANT: Do not remove the PIM top cover screws.

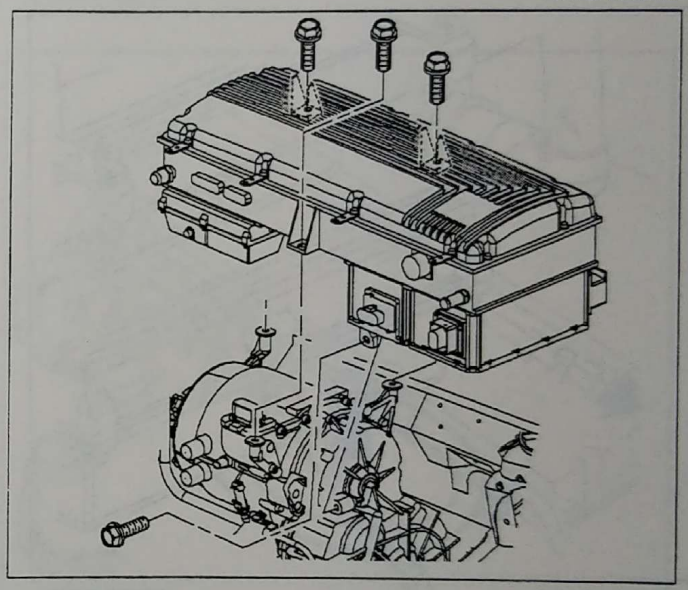
19. Remove the wire clips retaining the PEB harness to the front PIM cover brackets and remove the PEB harness away from the PEB.

20. Remove the coolant hose at the "T" going into the expansion tank.



PSMPEN66021AA

21. Remove the lower PEB to drive unit bolt located just to the right of the PEB center, below the top of the engine strut.
22. Remove the remaining PEB to drive motor bolts.
23. Using two people, one at each end of the PEB lift the assembly straight up disconnecting it from the drive motor and continue lifting until the lower attachment tab clears the front of vehicle. Remove the PEB.



PSMPEN65834AB

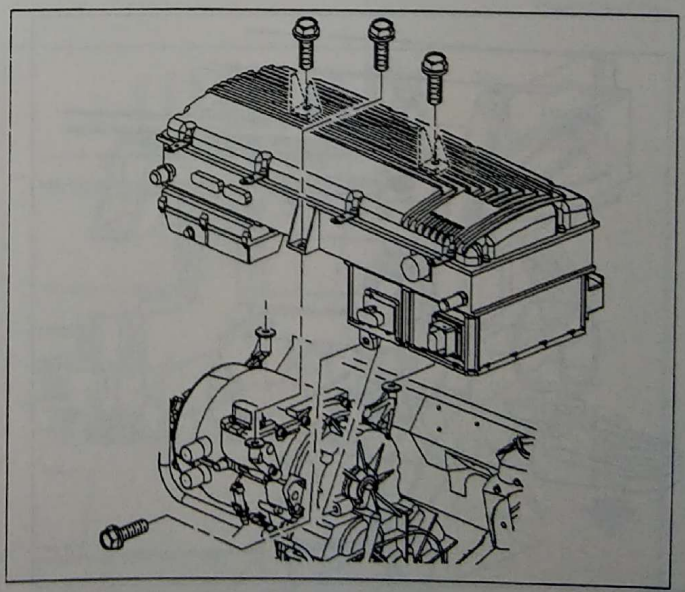
INSTALLATION

1. Using two people position the PEB over the drive motor connection point. Carefully lower the PEB over the drive motor and into position.
2. Install the top PEB to drive motor bolts. Lightly tightened all bolts.
3. Install the lower PEB to drive motor bolt located just to the right of the PEB center, below the top of the engine strut.

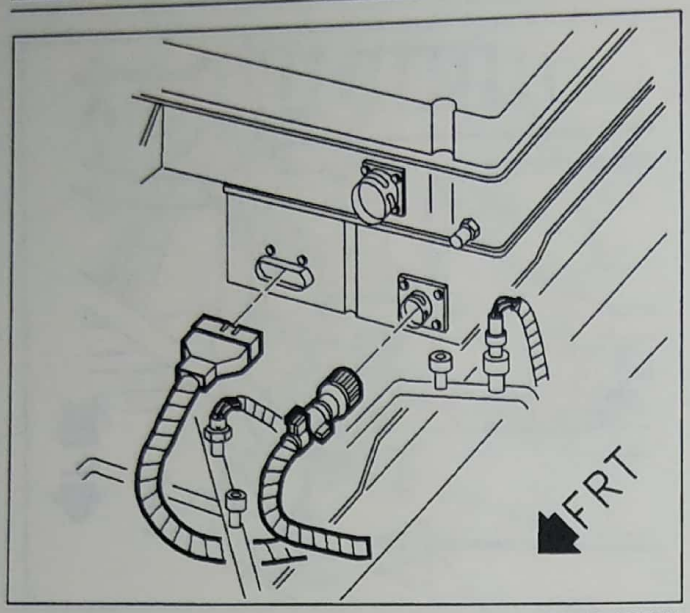
Torque: 35 N•m (26 ft–lbs)

4. Torque the top PEB to motor bolts

Torque: 63 N•m (46 ft–lbs)

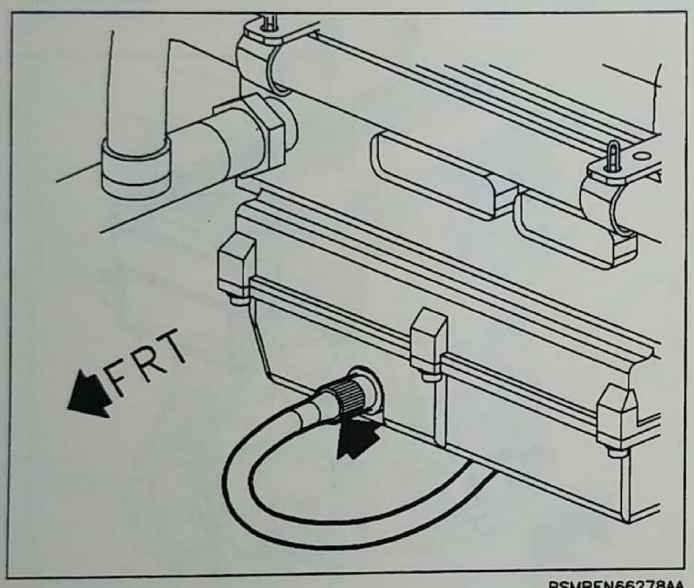


PSMPEN65834AB



PSMGCH66073AA

5. Connect the APM 24−way connector and the APM cannon connector.

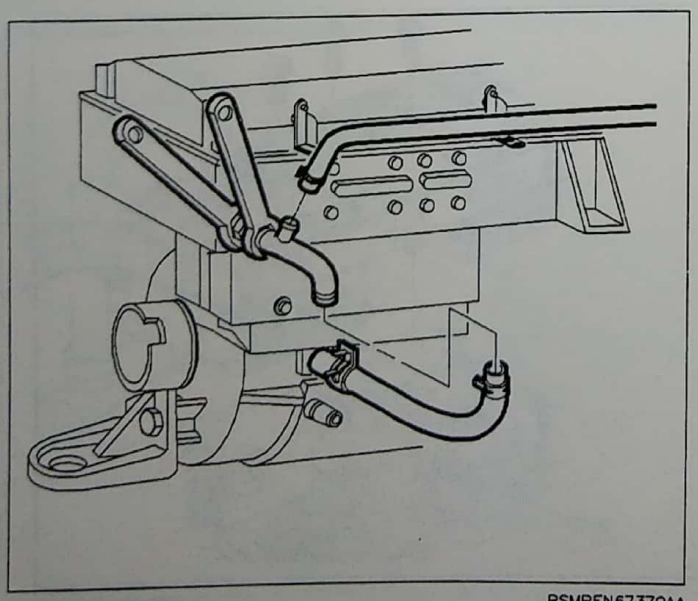


PSMPEN66278AA

6. Connect the PSCM 5−way connector. (Yellow cable).

NOTICE: Make sure connector is properly aligned to the connection at the PSCM prior to installation, this will help avoid damaging connector pins.

7. Remove the two PIM coolant plugs.



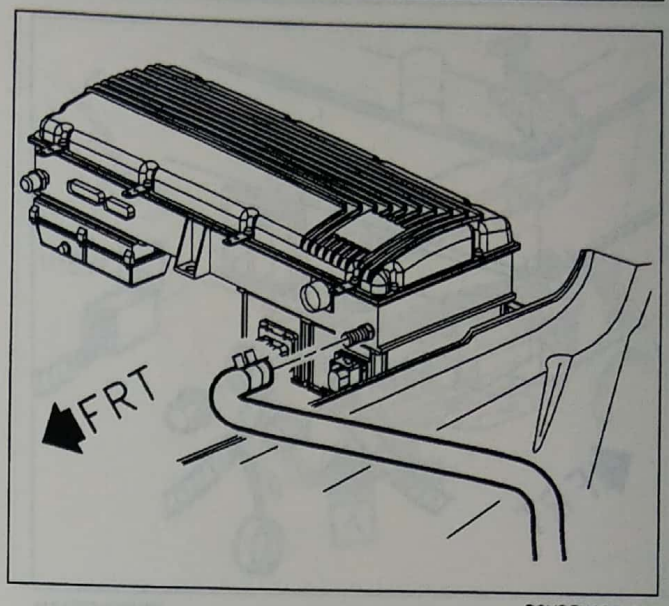
PSMPEN67370AA

8. Install cooling outlet hose to PIM.

Torque: 36 N•m (27 ft−lbs)

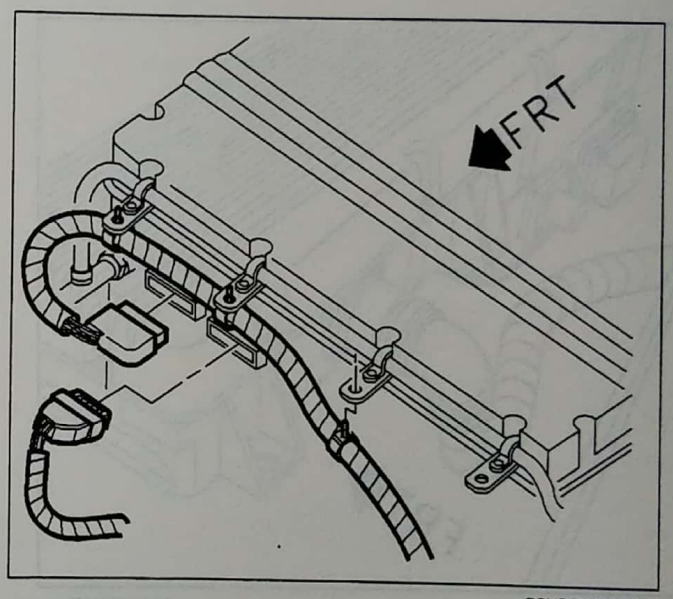
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, fittings or components

9. Install hose and clamp on PIM inlet cooling fitting. Position clamp tangs at 2 o'clock.



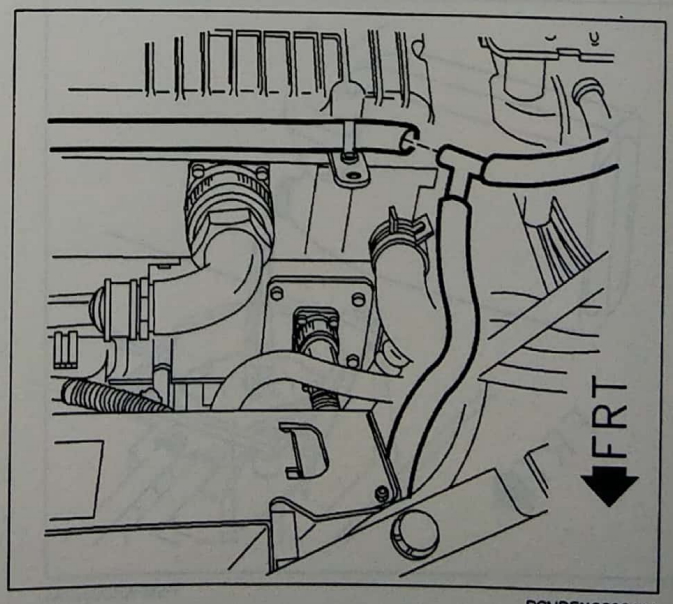
PSMPEN66020AA

10. Connect 32–way and the 24–way connectors at the front of the PIM.
11. Install the wire clips to retain PEB harness to the front PIM cover brackets.

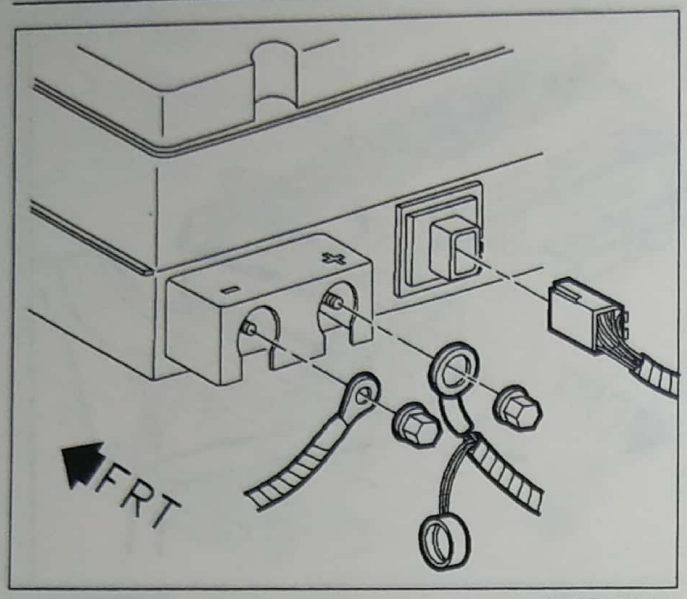


PSMPEN66075AA

12. Install vent hose to vent "T."

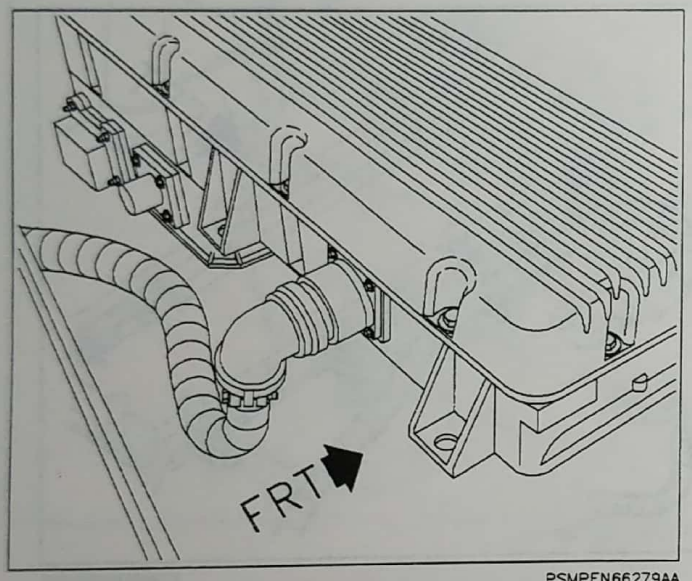


PSMPEN66021AA



PSMPEN66019AA

13. Connect the APM, 5–way connector at the rear of the APM.
14. Connect the negative and positive battery cables to the left rear of the APM.

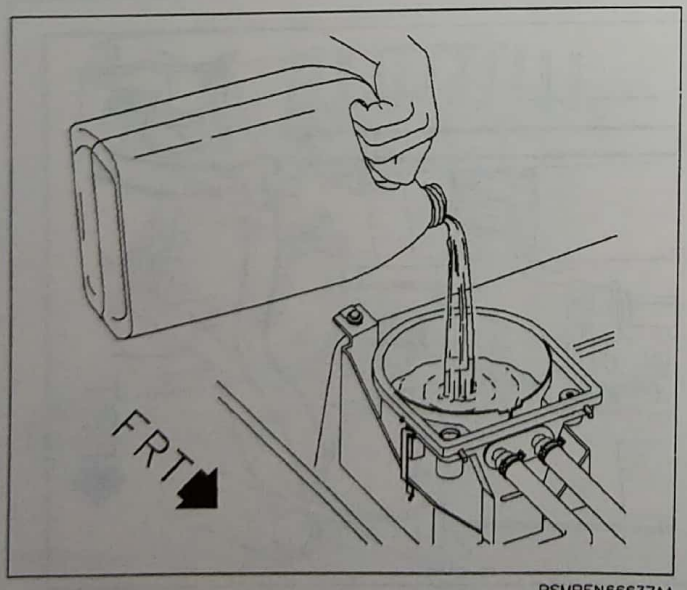


PSMPEN66279AA

15. Connect battery assembly pack cannon connector to right rear corner of the PIM. Tighten connector until indicator marks line-up.

NOTICE: Do not use any tools to reinstall the connector. Excessive force or misalignment can damage the connector pins.

16. Enable high voltage. (Refer to "High Voltage Enable" in this manual.)



PSMPEN66637AA

17. Check to insure that all the hoses and fittings are connected.
18. Fill coolant system until you reach the fill line on the expansion tank with GMEV coolant part 27002485 or equivalent which meets GM spec #9986100. The fluid level will drain down into the coolant system slowly and fluid should be added until the fluid level stabilizes.
19. Place vehicle in run mode. If vehicle does not power-up, refer to the "High Voltage" section of the service manual.
20. Maintain fluid level to fill line in expansion tank.
    a. After one minute turn on heat mode. Maintain fluid level to fill line in expansion tank.
    b. After one minute turn on vent mode.

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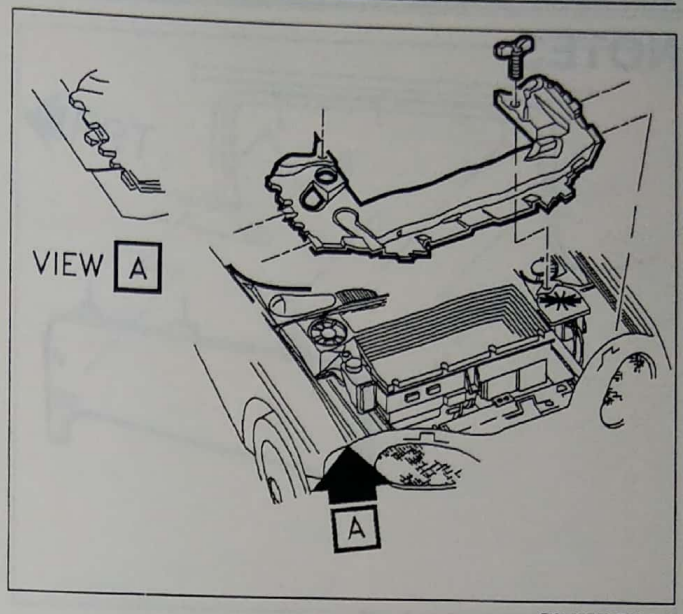
21. Repeat previous step two more times.
22. After one minute turn on heat mode.
23. Insert charger paddle into charger receptacle. Verify charger is operating.
24. Maintain fluid level to fill line in expansion tank.
25. After one minute remove charger paddle from charger receptacle.
26. Turn HVAC system to vent mode.
27. Insert charger paddle into charger receptacle. Verify charger is operating.
28. After two minutes remove charger paddle from charger receptacle. Top off fluid level to fill line, install cover on expansion tank and check for leaks.
29. Install engine compartment sight shield.
30. Clear all codes using PDT.
31. Raise vehicle on hoist.
32. Install front underbody air deflector. (Refer to "Front Underbody Air Deflector Installation" procedure in this manual.)



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NOTES

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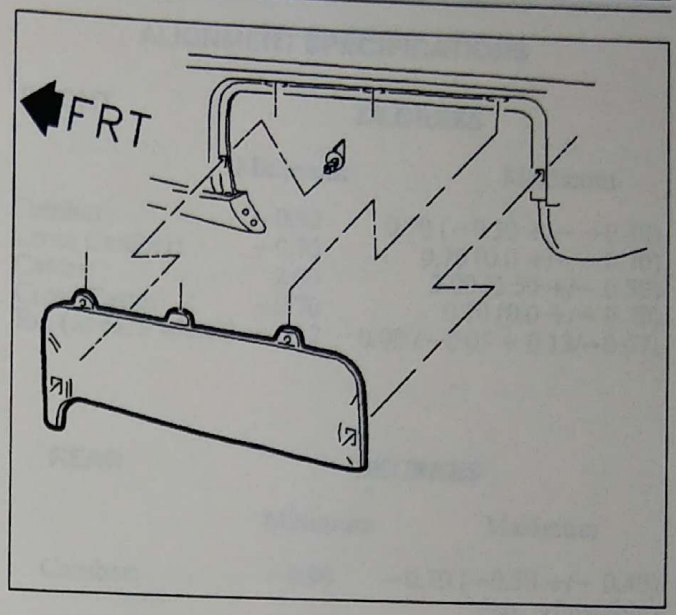
MEASUREMENT AND SPECIFICATIONS

CURB TRIM HEIGHTS

IMPORTANT: When measuring alignment angles, it is critical that the vehicle trim height be correct! Measure and adjust trim height according to the following procedure before performing alignment.

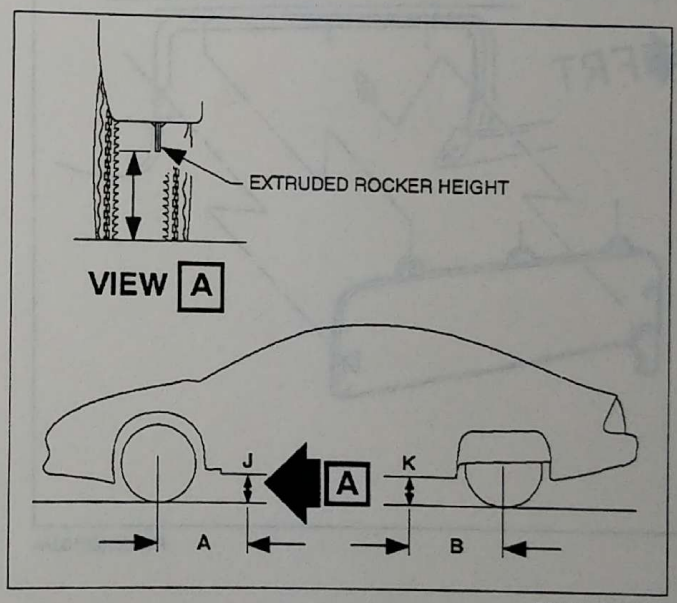
1. Place vehicle on a level surface.
2. Remove rear wheel opening covers.
3. Adjust tire pressures to correct specifications.
   a. Adjust air pressure in all tires to 345 kPa (50 psi).
   b. Reset "Check Tire Pressure System." Depress the switch located on the underside of the rear compartment lid for more than one second.
4. Bounce front and rear suspension a few times to settle suspension.
5. Measure front and rear vehicle curb trim height.



PSMGCH60103AA

Measure from the center line of the front wheel rearward to obtain measuring point **"A"**. Measure from the center line of the rear wheel forward to obtain measuring point **"B"** horizontal measurement. Measuring points **"J"** and **"K"** are the vertical measurement.

A	B
650 mm (25.6 in)	550mm (21.7 in)



PSMGCH65566AB

Measure the curb trim height from the level surface the vehicle rests on to the bottom horizontal surface of the extruded metal rocker. **Do not measure from the bottom of the rocker panel.**

Curb Trim Height:

J
Front Extruded Rocker Height

149.0 mm (5.87 in) – 183.8 mm (7.24 in)
Nominal
166.4 mm (6.56 in)

K
Rear Extruded Rocker Height

160.0 mm (6.30 in) – 186.0 mm (7.32 in)
Nominal
173.0 mm (6.82 in)

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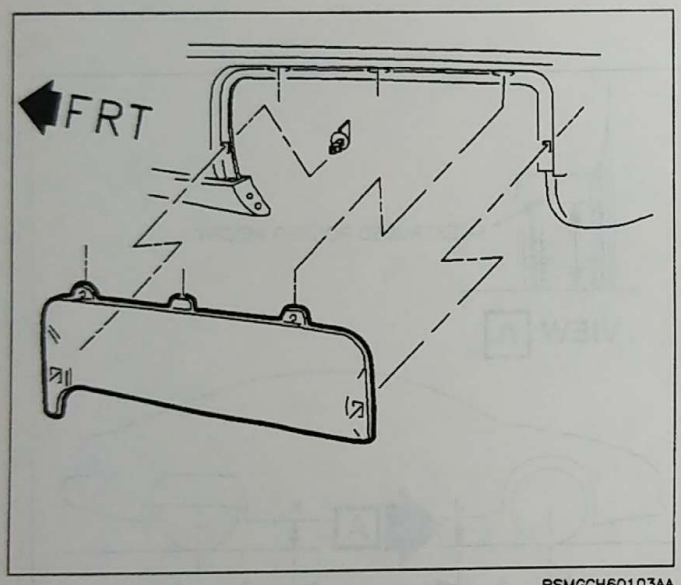
ALIGNMENT SPECIFICATIONS

IMPORTANT: When measuring alignment angles, it is critical that the vehicle curb trim height be correct. If not correct, add or remove weight until trim height is correct. (Refer to "Curb Trim Heights" in this manual).

IMPORTANT: When performing a wheel alignment after any suspension system component removal and installation, the vehicle must be driven and/or the suspension system worked (manually bounced at least 20 times) to allow components to locate properly before alignment adjustment.

1. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)
2. Place shifter in neutral and keypad in **OFF** mode.
3. Release park brake, if applied.



PSMGCH60103AA

4. Remove rear wheel opening covers.
5. Adjust tire pressures to correct specifications
   a. Adjust air pressure in all tires to 345 kPa (50 psi).
   b. Reset "Check Tire Pressure System." Depress the switch located on the underside of the rear compartment lid for more than one second.
6. Install alignment equipment in accordance with the equipment manufacturers instructions.

NOTICE: If lifting of vehicle is required while the vehicle is on the alignment rack. Lift the front of vehicle using the front lower control arms. Place lifting pads on lower control arms between yoke attachment and lower ball joint. Lifting of the rear of vehicle using the rear axle. Place lifting pads under rear axle spring cups. Do not attempt to lift rear of vehicle using the center section of rear axle.

7. Check cradle for damage and alignment. Right rear cradle mounting bolt hole is slotted for alignment adjustment (cradle to body). If cradle to body alignment is not correct, loosen cradle fasteners and align cradle to body.
8. Measure alignment angles for each wheel.

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ADJUSTMENT

ORDER OF ADJUSTMENT

First:	Check rear camber (not adjustable)
Second:	Check rear toe (not adjustable)
Third:	Front camber
Fourth:	Front caster
Fifth:	Front cross-camber
Sixth:	Front cross-caster
Seventh	Front toe

IMPORTANT: When performing a wheel alignment after any suspension system component removal and installation, the vehicle must be driven and/or the suspension system worked (manually bounced at least 20 times) to allow components to locate properly before alignment adjustment.

REAR WHEEL ALIGNMENT

Rear wheel alignment involves checking two alignment angles (camber and toe). Rear wheel camber, toe and caster are not adjustable.

IMPORTANT: Rear wheel alignment must be within specifications before front wheel alignment is attempted.

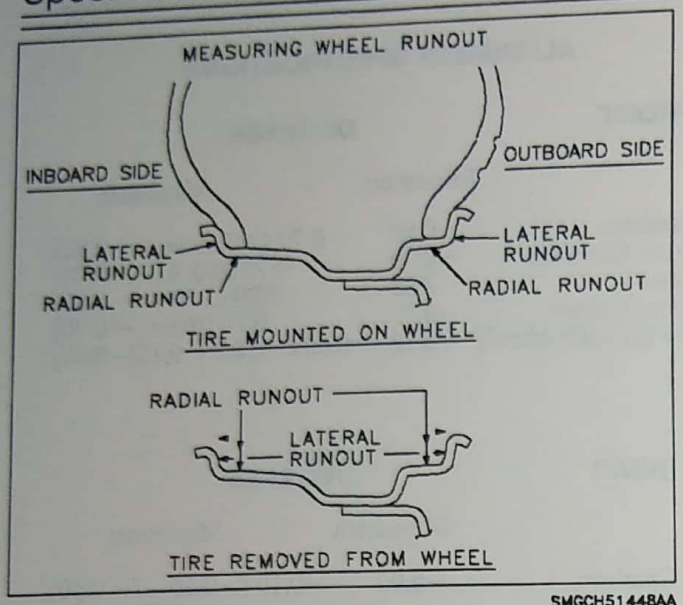
ALIGNMENT SPECIFICATIONS

FRONT

	DEGREES	
	Minimum	Maximum
Camber:	−0.90	0.70 (−0.10 +/− −0.80)
Cross Camber:	−0.70	0.70 (0.0 +/− −0.70)
Caster:	2.00	3.00 (2.50 +/− 0.50)
Cross Caster:	−0.70	0.70 (0.0 +/− 0.70)
Toe (at each wheel)	−0.12	0.08 (−0.05 + 0.13/−0.07)

REAR

	DEGREES	
	Minimum	Maximum
Camber:	−0.90	−0.10 (−0.50 +/− 0.40) (not adjustable)
Toe (at each wheel)	−0.30	0.30 (0.00 +/− 0.30) (not adjustable)



WHEEL RUNOUT

MEASURING

Wheel runout should be measured with an accurate dial indicator. Measurements may be taken with the wheel installed on the vehicle (be sure wheel bearings do not have excessive free play) or off the vehicle on an accurate mounting fixture (such as a wheel balancing machine). Measure the radial and lateral runout of both the inboard and outboard rim flanges.

1. Place dial indicator in a rigid fixture and position against wheel.
2. Slowly rotate the wheel at least one full revolution while observing dial indicator.
3. Rotate wheel to position where the lowest dial indicator reading was observed.
4. Zero the dial indicator.
5. Slowly rotate the wheel one full revolution while observing dial indicator.
6. Record highest dial indicator reading. This is the wheel runout.

IMPORTANT: Disregard any indicator readings due to welds, scratches, paint runs, etc.

SPECIFICATIONS

	Radial Runout mm (in.)	Lateral Runout mm (in.)
Aluminum Wheel	0. 76 (0. 030)	0. 76 (0. 030)

Hub and Bearing Assemblies:

Front	
End Play	0.130 mm (.005 in)
Lateral Runout	0.038 mm (.0015 in)
Rear	
End Play	0.130 mm (.005 in)
Lateral Runout	0.038 mm (.0015 in)
Radial Runout	0.130 mm (.005 in)

Exterior Dimensions	
Wheelbase	2512 mm (98.9 in)
Overall Length	4309 mm (169.7 in)
Overall Width	1766 mm (69.5 in)
Overall Height	1281 mm (50.5 in)
Track Front	1470 mm (57.9 in)
Track Rear	1244 mm (49.0 in)
Curb Weight	1350 kg (2970 lbs)
Frontal Area	1.89 sq. m.
Drag Coefficient	0.19
Tire Size	175/65R14
Tire Pressure	345 kPa (50 psi)

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Power Steering System

Electrohydraulic Power Steering (EHPS) Pump/Motor

AC Induction Motor	
Volts	180 VRMS AC, 3 Phase
Watts (Input)	1200 DC
Maximum Operating Speed	2500 RPM
Maximum Flow	3.80 LPM (1GPM)
Maximum Pressure	5900 kPa (850 psi) +/– 1000 kPa (150 psi)
Power Steering System Fluid Capacity	0.7 liters (24 ounces)
Steering Ratio	16.38 : 1
Steering Type	Electrohydraulic Power Steering, Rack – and – Pinion

NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 998531) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

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ALIGNMENT, WHEELS & TIRES (CHWT)

DIAGNOSIS

ROAD TEST

Use the following flow chart to determine if a vehicle pull is most likely caused by steering pull or torque steer. Perform the road test on a flat level road and with minimum wind conditions.

Drive — Steady Speed: 72 – 88 kmh (45 – 55 mph) in drive Maintaining a steady speed

Neutral — Coast: 72 – 88 kmh (45 – 55 mph) in neutral Coasting

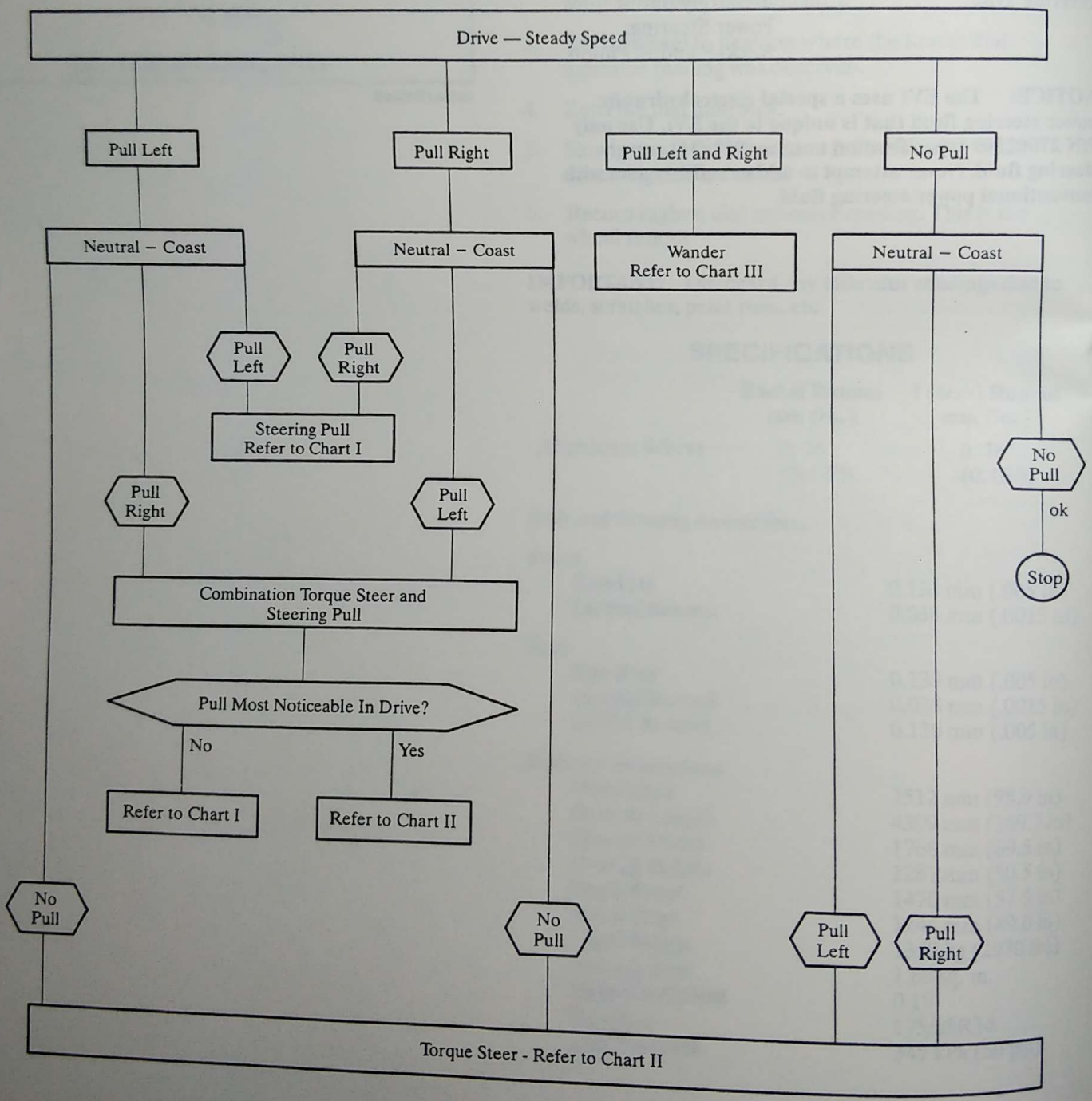


CHART I

FRONT WHEEL DRIVE STEERING PULL CORRECTION CHART

- Check suspension components for excessive wear and/or damage.
- Check tires for abnormal or excessive wear.
- Adjust tire pressures to correct specifications. Reset check tire pressure system.
- Check brakes for drag.

Road Test → ok → Stop

Car Pulls

Cross Switch (LF ↔ RF) Front Tire and Wheel Assemblies

Road Test → ok → Stop

Pulls Same Direction

Probable cause is wheel alignment.

Position front tire and wheel assemblies to location which caused the least amount of pull.

Perform Full Vehicle Alignment:

When performing alignment, keep cross camber and cross caster as close to zero as possible. Do not exceed ± 0.4°.

Road Test → ok → Stop

Pull Left

Increase negative camber (Additional −0.5°) on left front and positive camber (Additional +0.5°) on right front

Road Test → ok → Stop

Pull Left

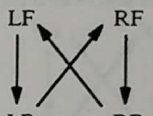
Increase negative camber on left front and positive camber on right front until pull is eliminated.

Do Not Exceed 2° Cross Camber

Pulls Opposite Direction

Probable cause is tires.

Rotate All Tires and Wheel Assemblies



Road Test → ok → Stop

Pull Left

Switch RF and LR tire and wheel assemblies.

Road Test → ok → Stop

Pull Right

Increase positive camber (Additional +0.5°) on left front and negative camber (Additional −0.5°) on right front

Road Test → ok → Stop

Pull Right

Increase positive camber on left front and negative camber on right front until pull is eliminated.

Pull Right

Switch LF and LR tire and wheel assemblies.

Road Test → ok → Stop

CHART II

FRONT WHEEL DRIVE TORQUE STEER CORRECTION CHART

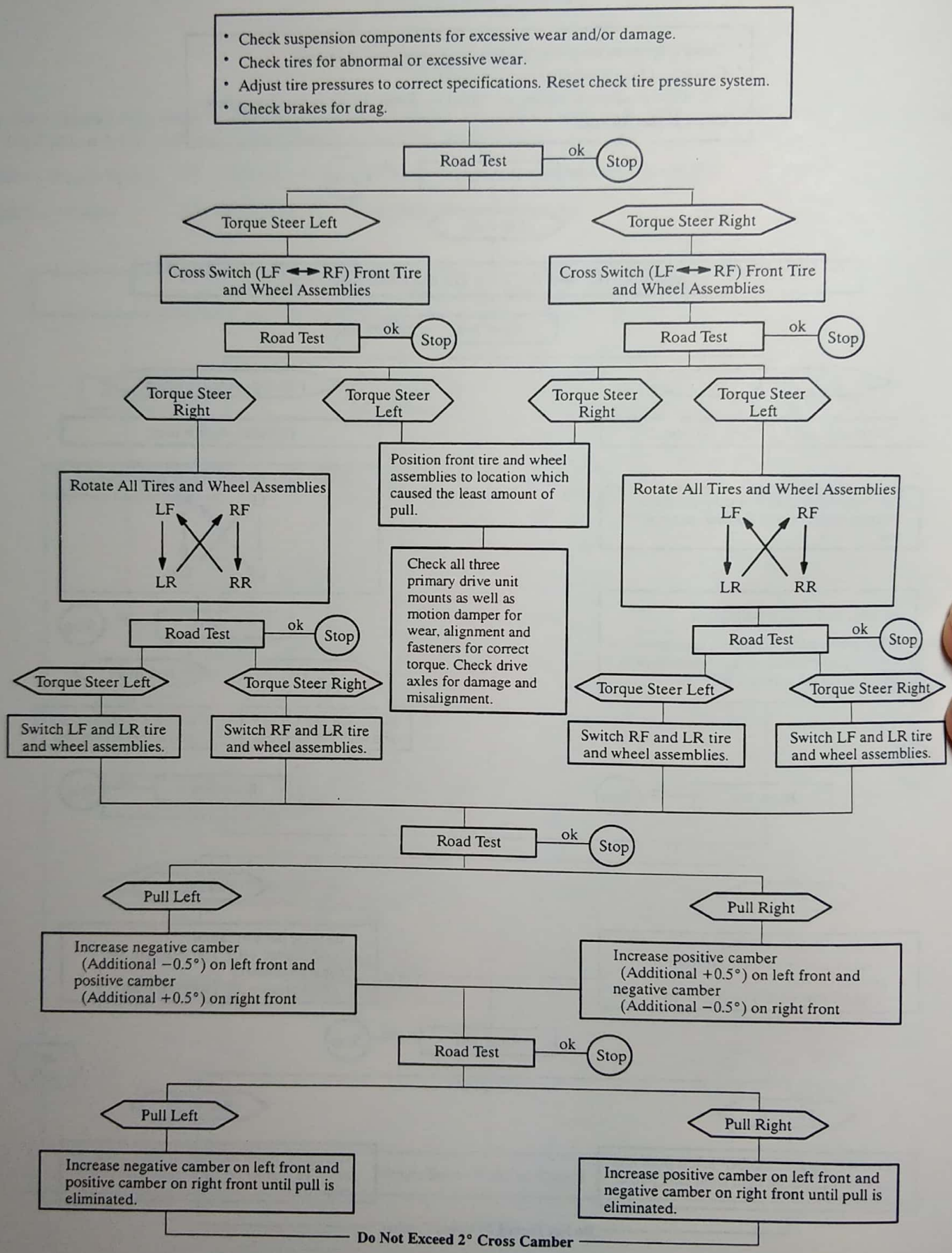
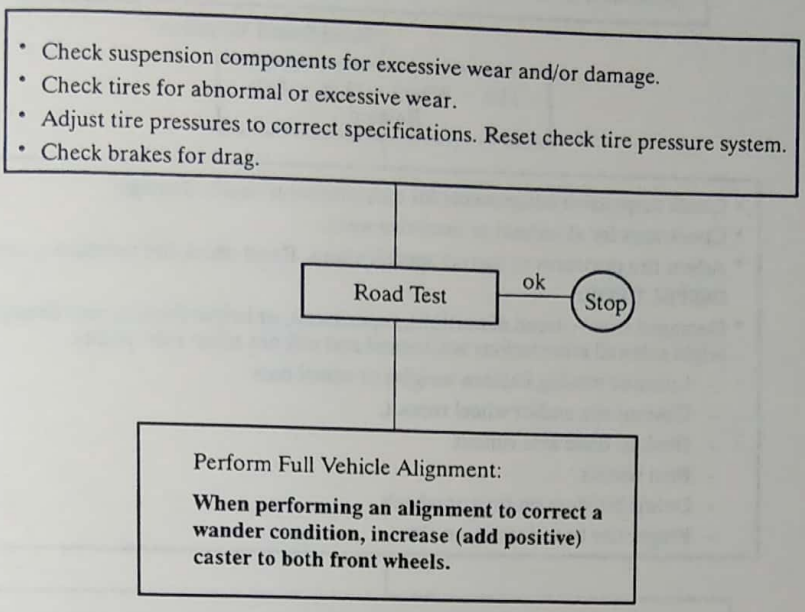

• Check suspension components for excessive wear and/or damage.
• Check tires for abnormal or excessive wear.
• Adjust tire pressures to correct specifications. Reset check tire pressure system.
• Check brakes for drag.
Road Test
ok
Stop
Torque Steer Left
Torque Steer Right
Cross Switch (LF ↔ RF) Front Tire and Wheel Assemblies
Cross Switch (LF ↔ RF) Front Tire and Wheel Assemblies
Road Test
ok
Stop
Road Test
ok
Stop
Torque Steer Right
Torque Steer Left
Torque Steer Right
Torque Steer Left
Rotate All Tires and Wheel Assemblies
LF
RF
LR
RR
Position front tire and wheel assemblies to location which caused the least amount of pull.
Check all three primary drive unit mounts as well as motion damper for wear, alignment and fasteners for correct torque. Check drive axles for damage and misalignment.
Rotate All Tires and Wheel Assemblies
LF
RF
LR
RR
Road Test
ok
Stop
Road Test
ok
Stop
Torque Steer Left
Torque Steer Right
Torque Steer Left
Torque Steer Right
Switch LF and LR tire and wheel assemblies.
Switch RF and LR tire and wheel assemblies.
Switch RF and LR tire and wheel assemblies.
Switch LF and LR tire and wheel assemblies.
Road Test
ok
Stop
Pull Left
Pull Right
Increase negative camber (Additional −0.5°) on left front and positive camber (Additional +0.5°) on right front
Increase positive camber (Additional +0.5°) on left front and negative camber (Additional −0.5°) on right front
Road Test
ok
Stop
Pull Left
Pull Right
Increase negative camber on left front and positive camber on right front until pull is eliminated.
Increase positive camber on left front and negative camber on right front until pull is eliminated.
Do Not Exceed 2° Cross Camber

CHART III

FRONT WHEEL DRIVE WANDER CORRECTION CHART


• Check suspension components for excessive wear and/or damage.
• Check tires for abnormal or excessive wear.
• Adjust tire pressures to correct specifications. Reset check tire pressure system.
• Check brakes for drag.
Road Test
ok
Stop
Perform Full Vehicle Alignment:
When performing an alignment to correct a wander condition, increase (add positive) caster to both front wheels.

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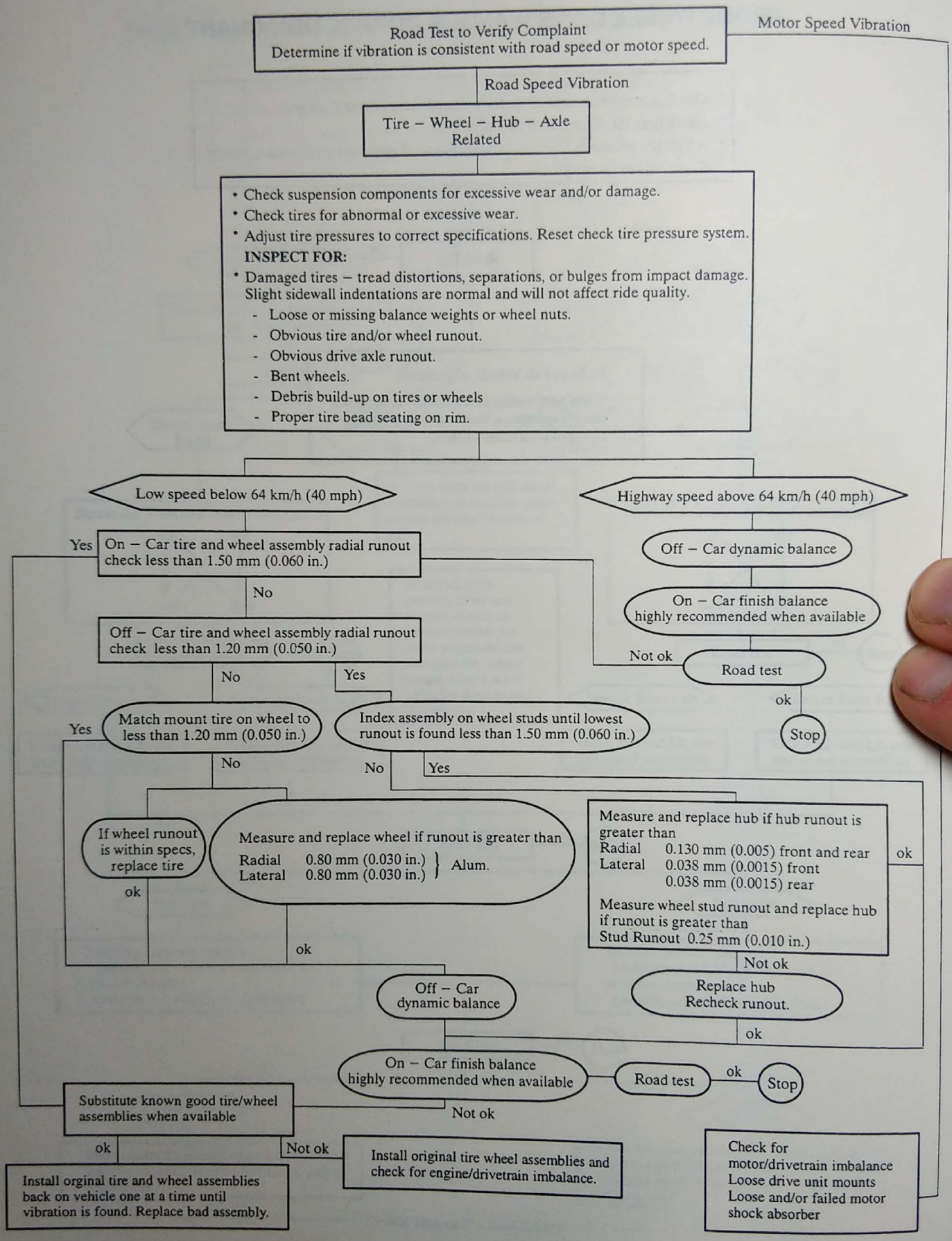
VIBRATION COMPLAINT


Road Test to Verify Complaint
Determine if vibration is consistent with road speed or motor speed.
Motor Speed Vibration
Road Speed Vibration
Tire – Wheel – Hub – Axle Related
• Check suspension components for excessive wear and/or damage.
• Check tires for abnormal or excessive wear.
• Adjust tire pressures to correct specifications. Reset check tire pressure system.
INSPECT FOR:
• Damaged tires – tread distortions, separations, or bulges from impact damage. Slight sidewall indentations are normal and will not affect ride quality.
- Loose or missing balance weights or wheel nuts.
- Obvious tire and/or wheel runout.
- Obvious drive axle runout.
- Bent wheels.
- Debris build-up on tires or wheels
- Proper tire bead seating on rim.
Low speed below 64 km/h (40 mph)
Highway speed above 64 km/h (40 mph)
Yes
On – Car tire and wheel assembly radial runout check less than 1.50 mm (0.060 in.)
No
Off – Car tire and wheel assembly radial runout check less than 1.20 mm (0.050 in.)
No
Yes
Yes
Match mount tire on wheel to less than 1.20 mm (0.050 in.)
Index assembly on wheel studs until lowest runout is found less than 1.50 mm (0.060 in.)
No
No
Yes
If wheel runout is within specs, replace tire
ok
Measure and replace wheel if runout is greater than
Radial 0.80 mm (0.030 in.)
Lateral 0.80 mm (0.030 in.)
Alum.
ok
Measure and replace hub if hub runout is greater than
Radial 0.130 mm (0.005) front and rear
Lateral 0.038 mm (0.0015) front
0.038 mm (0.0015) rear
ok
Measure wheel stud runout and replace hub if runout is greater than
Stud Runout 0.25 mm (0.010 in.)
Not ok
Replace hub
Recheck runout.
ok
Off – Car dynamic balance
On – Car finish balance highly recommended when available
Road test
ok
Stop
Substitute known good tire/wheel assemblies when available
Not ok
ok
Not ok
Install orginal tire and wheel assemblies back on vehicle one at a time until vibration is found. Replace bad assembly.
Install original tire wheel assemblies and check for engine/drivetrain imbalance.
Off – Car dynamic balance
On – Car finish balance highly recommended when available
Not ok
Road test
ok
Stop
Check for
motor/drivetrain imbalance
Loose drive unit mounts
Loose and/or failed motor
shock absorber

NOTES

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WHEELS AND TIRES DIAGNOSIS

VIBRATION COMPLAINT TIRE-WHEEL-HUB RELATED

A vibration that is tire or wheel induced can be caused by two factors: imbalance or runout.

Low-speed vibrations, those less than 64 km/h (40 mph), are usually runout related. Highway speed vibrations, those above 96 km/h (60 mph), can be caused by either imbalance or runout.

Prior to performing any work, always road test the vehicle and perform a careful visual inspection for:

- Obvious tire and wheel runout.
- Obvious drive axle runout.
- Proper tire inflation pressure.
- Bent wheels.
- Debris build-up on the tire or wheel.
- Loose or missing wheel weights or wheel nuts.
- Irregular or excessive tire wear.
- Proper tire bead seating on rim.
- Damaged tires, such as tread distortions, separations, or bulges from impact damage. Slight sidewall indentations are normal and will not affect ride quality.

Balance is the easiest procedure to perform and should, therefore, be done first if the vibration occurs at highway speeds. An off-car, two-plane dynamic balance should first be performed. This will correct any imbalance in the tire and wheel assembly.

An on-car finish balance should then be performed to correct any brake drum, rotor imbalance. Follow the balancing procedures of the balancing machine being used.

If balance does not correct the highway speed vibration, or if the vibration is at low speeds, runout is the probable cause. Runout can be caused by the tire, wheel, or the way the wheel attaches to the vehicle. The following procedure should be used.

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A. If runout is suspected, the free runout of the tire and wheel assembly should first be measured on the vehicle. A dial indicator with a roller wheel is preferable, but a dial indicator with button end may be used. Lateral runout (side-to-side) should be measured on the tire's sidewall as close to the tread shoulder as possible. Radial runout (up and down) should be measured on the center tread rib. Some tread designs may require tightly wrapping a piece of tape around the center tread circumference for better dial indicator contact; for measuring wheel runout follow the procedures in this section. Whether measuring radial or lateral runout, disregard any instantaneous indicator needle jumps due to sidewall depressions, tread blocks, etc. Record the total indicator reading, and the location of the high point of runout. The total tire and wheel on-car runout should be less than 1.52 mm (0.060 in.), if either measurement exceeds 1.52 mm (0.060 in.), proceed to step B.

B. If the on-car radial or lateral runout measured in Step A exceeds 1.52 mm (0.060 in.), mount the tire and wheel assembly on a dynamic balance machine and again measure the amount of runout. Locate on the machine using the wheel's inside center pilot hole. Using the same procedure as in step A, record the amount of tire and wheel runout and its high point location. Next, measure wheel (refer to procedures in this section). If the wheel exceeds specifications, replace the wheel. If the tire and wheel radial or lateral runout exceeds 1.27 mm (0.050 in.) at the tire tread, proceed to step C.

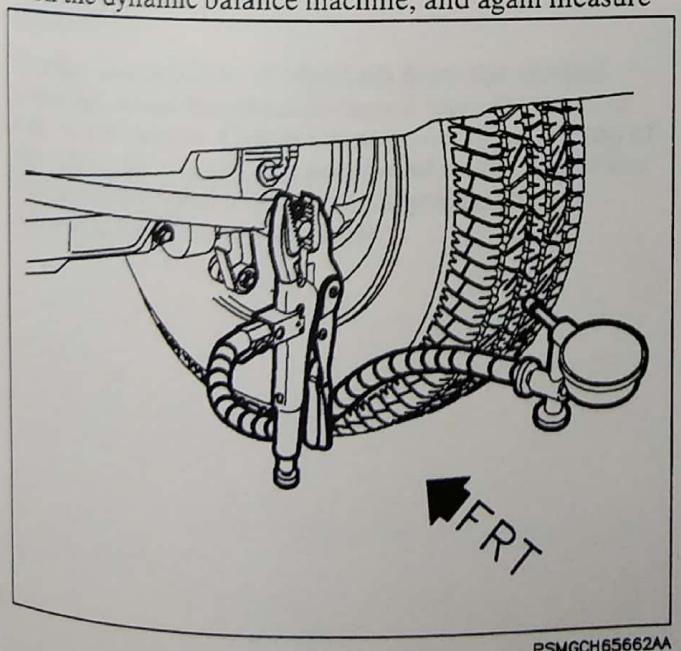
C. If the off-car tire and wheel radial or lateral runout measured in step B exceeds 1.27 mm (0.050 in.), match mount the high radial runout point of the tire to low radial runout point of wheel. Inflate, mount on the dynamic balance machine, and again measure and record the radial and lateral runout and its location, as done in step B. In many cases, match mounting the tire on the wheel will bring the assembly's runout into the acceptable range of less than 1.27 mm (0.050 in.).

D. If the runout of the tire and wheel assembly is within limits when measured off the vehicle, yet exceeds the limits when measured on the vehicle, the attachment of the tire and wheel assembly to the hub is the probable cause. Mark wheel relation to wheel stud. Remove wheel and tire assembly and rotate 90 degrees (1/4 turn) to next position and install. Check runout. Repeat this procedure to find best mounting location.

E. If the on-car radial or lateral runout still exceeds 1.52 mm (0.060 in.), check hub runout. Remove the necessary rotor or drum. Make sure all hub surfaces are free of rust, dirt, or any debris that could distort readings. Measure radial runout at the wheel pilot. Measure lateral runout at the hub's mating surface with the wheel. If radial runout exceeds 0.130 mm (0.005 in.) front or rear, replace hub. If lateral runout exceeds 0.038 mm (0.0015 in.) on the front, replace hub. If lateral runout exceeds 0.038 mm (0.0015 in.) on the rear, replace hub.

Whenever a tire is rotated on the wheel, or whenever a tire or wheel is replaced, the assembly must be balanced and check tire pressure system reset.

The substitution method of vibration diagnosis can also be used. Install a known good set of tire and wheel assemblies. If these correct the vibration, the original assemblies should be installed one at a time until the vibration returns. This will pinpoint the bad tire/wheel assembly, remember to reset check tire pressure system.



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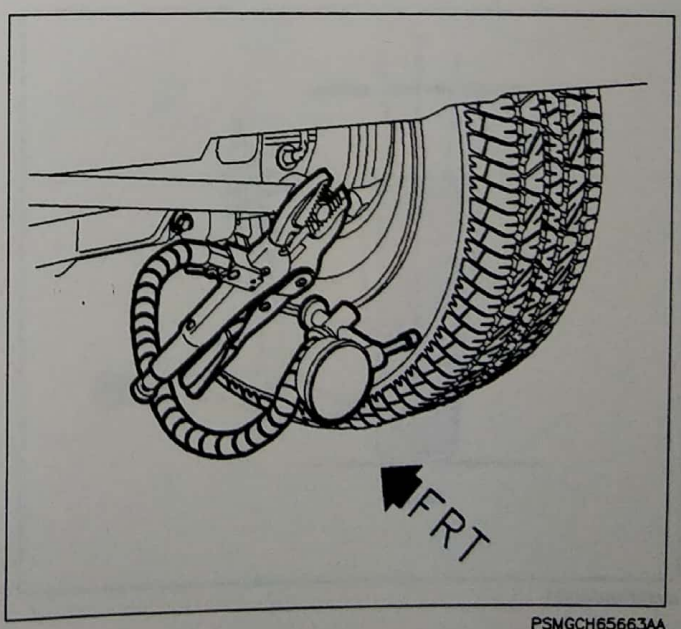

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INCORRECT TIRE INFLATION PRESSURE

Incorrect tire inflation pressure can lead to the following symptoms:

Over-inflation

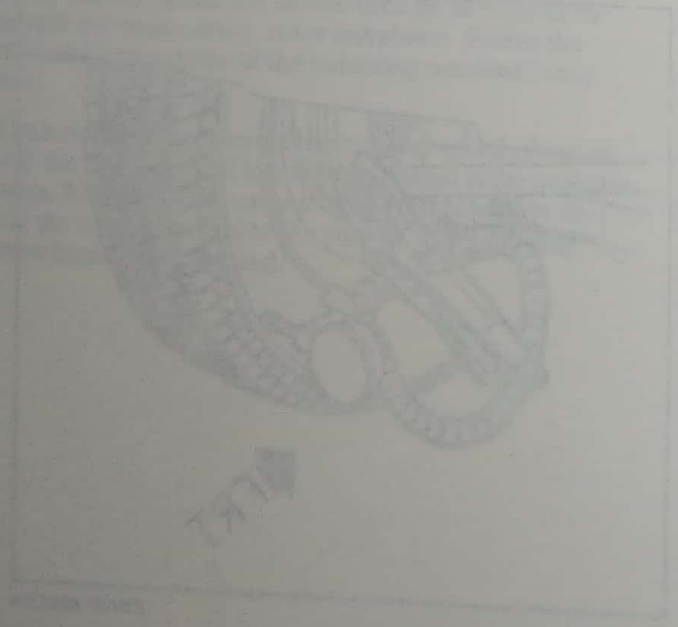
- Hard ride.
- Tire bruising or carcass damage.
- Rapid tread wear at center of tire tread.

Under-inflation

- Tire squeal on turns.
- High steering effort.
- Rapid tread wear on tire edges.
- Tire bruises or bead rupture.
- Tire cord breakage.
- High tire temperatures.
- Degraded handling.
- Reduced vehicle range.

Unequal-inflation pressure on same axle

- Uneven braking.
- Steering lead or pull.
- Degraded handling.
- Swerve on acceleration.



WHEEL ALIGNMENT

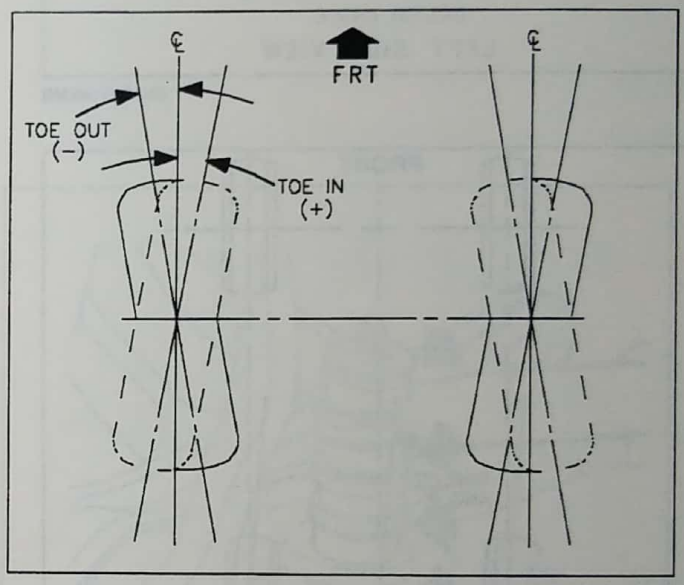
DEFINITIONS

WHEEL ALIGNMENT

Wheel alignment refers to the angular relationship between a vehicles wheels, suspension attaching points, and the ground. Vehicles with properly aligned front and rear suspensions handle predictably, and provide good straight line stability on the highway with minimal tire wear. In real world driving conditions, wheel alignment settings change over time due to suspension components wear or damage; they must be periodically checked and adjusted as necessary.

TOE

Toe is a measure of how far a wheel is turned in or out from the straight ahead direction. When the front of a wheel is turned in, the toe is positive (+). When turned out, the toe is negative (−). Toe affects tire wear.



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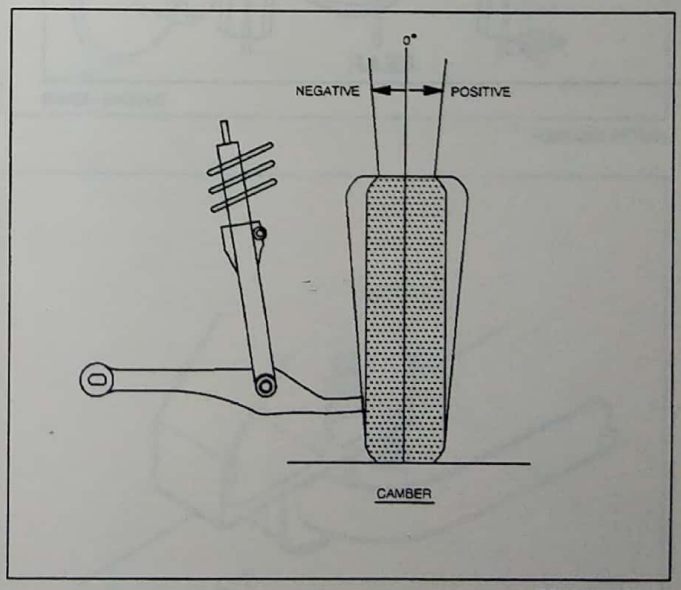
CAMBER

Camber is a measure of wheel tilt from the vertical direction, when the wheel is viewed from the front or rear of the vehicle. Camber is negative when the top of the wheel tilts inward and positive when the top of the wheel tilts outward. Camber settings influences directional control and tire wear.



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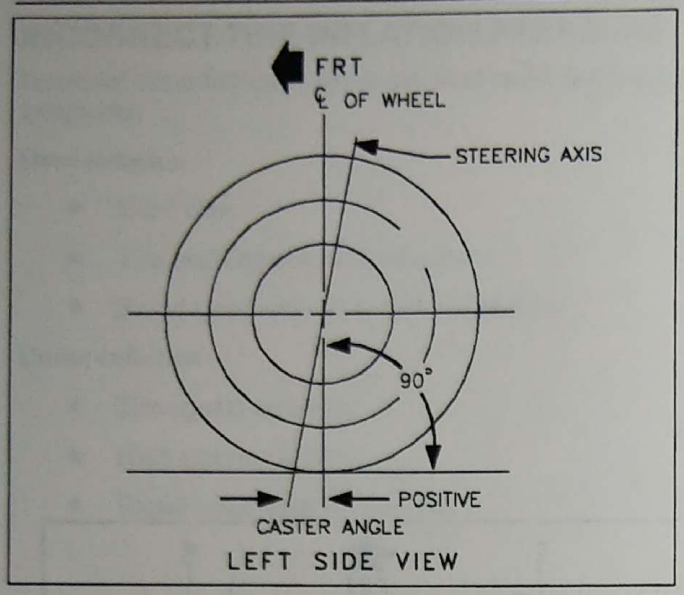

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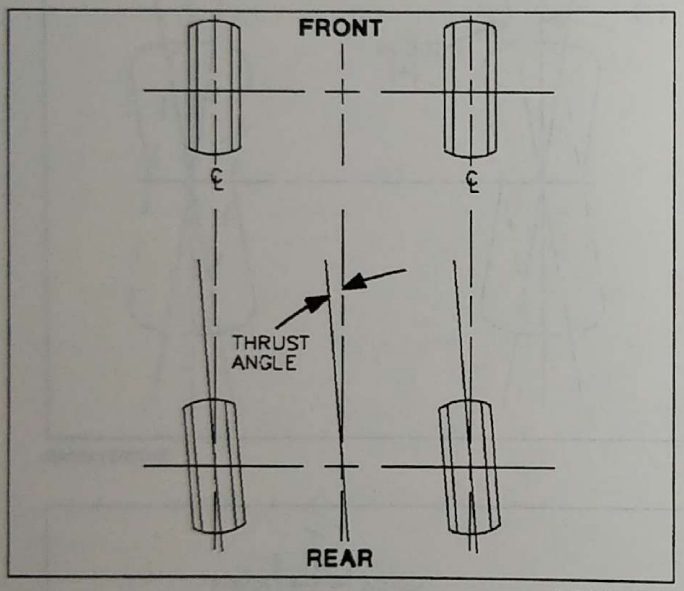
CASTER

Caster is the tilting of the front steering axis (at the top) either forward or backward from the vertical. A backward tilt is positive (+) and a forward tilt is negative (−). A line drawn through the center of the lower ball joint and the upper ball joint represents the steering axis. Caster influences directional control of the steering but does not affect tire wear and is adjustable only at the front tire and wheel assemblies.



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THRUST ANGLE

The front tire and wheel assemblies aim or steer the vehicle, but the rear tire and wheel assemblies control tracking. This tracking action is relative to thrust angle. Thrust angle is defined as the path that the rear tire and wheel assemblies will take. Ideally, the thrust angle is geometrically aligned with the body centerline (thrust angle is equal to zero).

CROSS CAMBER/CASTER

Cross camber and cross caster specifications refer to the difference between the left and right side angles. Cross camber and cross caster can influence vehicle steering pull tendencies. Usually, alignment results will be best when these measurements are as close to zero as possible.

(L) − (R) = CROSS

For example:

LF CAMBER	RF CAMBER	CROSS CAMBER	
−.90	**+.50**	**−1.40**	**OUT OF SPEC NOT OK**

(−.90) − (+.50) = −1.40

−.60	**−.30**	**−.30**	**WITHIN SPEC OK**

(−.60) − (−.30) = −.30

INSPECTION AND MEASUREMENTS

PRELIMINARY CHECKS

ROAD TEST VEHICLE

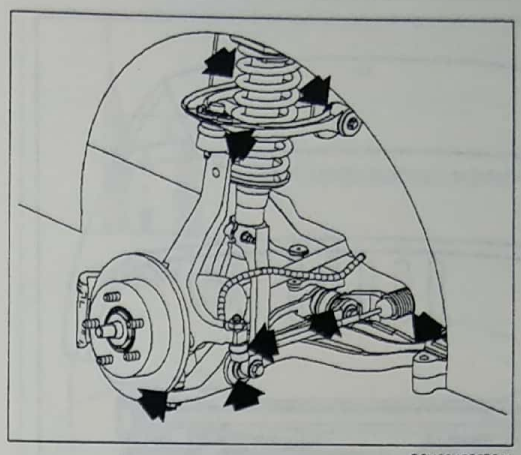
Road test the vehicle first. This gives clues to the condition of components in steering and suspension systems.

INSPECT TIRES

Inspect tires for wear and proper inflation pressure of 345 kPa (50 psi). Reset "Check Tire Pressure System." Depress the switch located on the underside of the rear compartment lid for more than one second.

Check:

1. That both tires on axle have about the same wear.
2. The wear pattern across the tire. This is very helpful in diagnosing alignment and steering or suspension problems.
3. The wheels and tires for run-out, if suspect.



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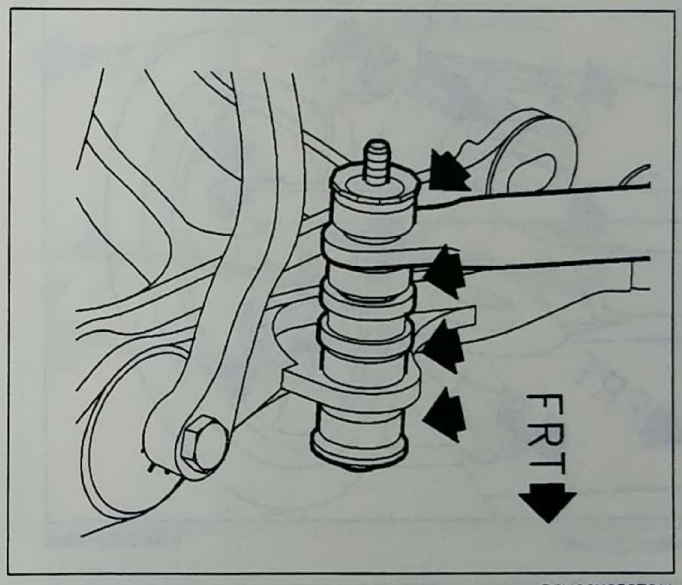
INSPECT FRONT SUSPENSION

Inspect steering and suspension systems for damage or wear. Alignment angles cannot be set accurately if steering or suspension systems are worn or damaged.

1. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this service manual.)
2. Check suspension/steering components for wear or damage.
   - Is the cradle damaged?
   - Is the wheel runout excessive? (Check wheel bearings, wheels and hub).
3. Check stabilizer bar, link assemblies and bushings for wear or damage.
4. Check lower and upper ball joints, also check for worn bushings or bent or damaged control arms.
5. Check steering gear for wear or damage as well as the intermediate shaft.
6. Check inner and outer tie rod ends for wear or damage.
7. Check shock absorber assemblies for wear, binding, bent or any other damage.
8. Check trim heights. Height must be correct before setting alignment.



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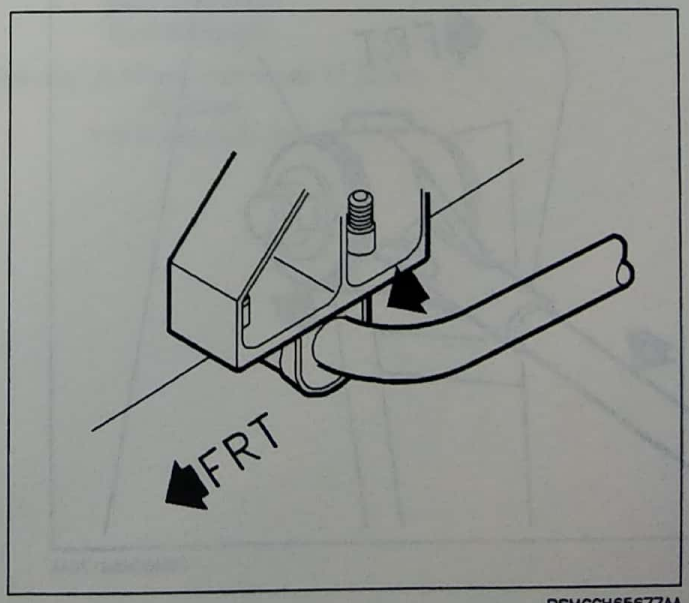

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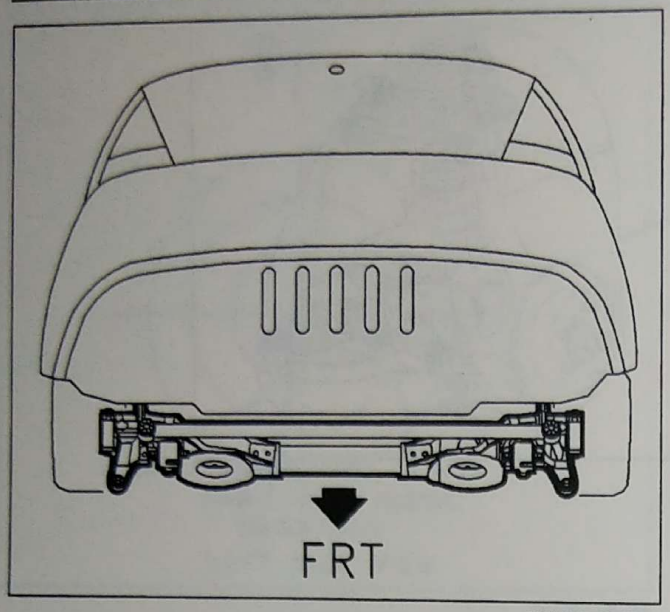

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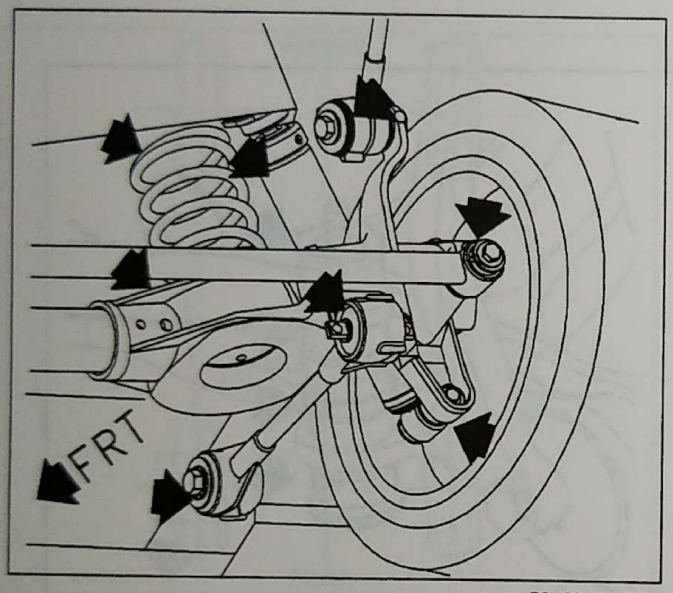

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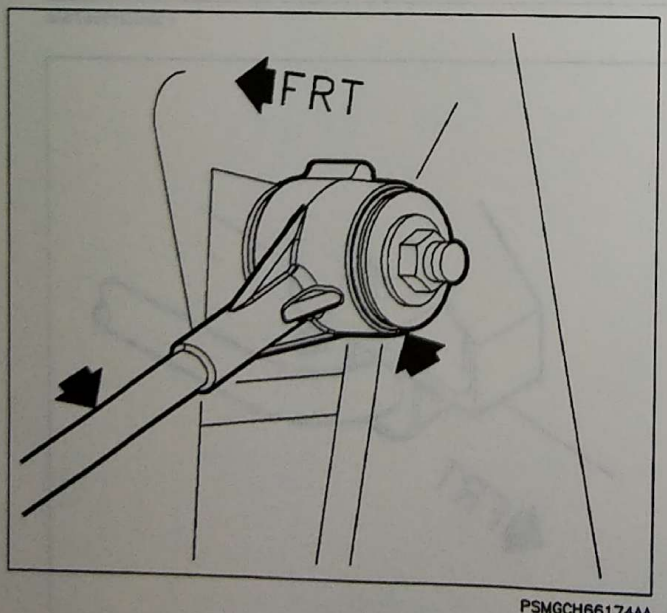

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INSPECT REAR SUSPENSION

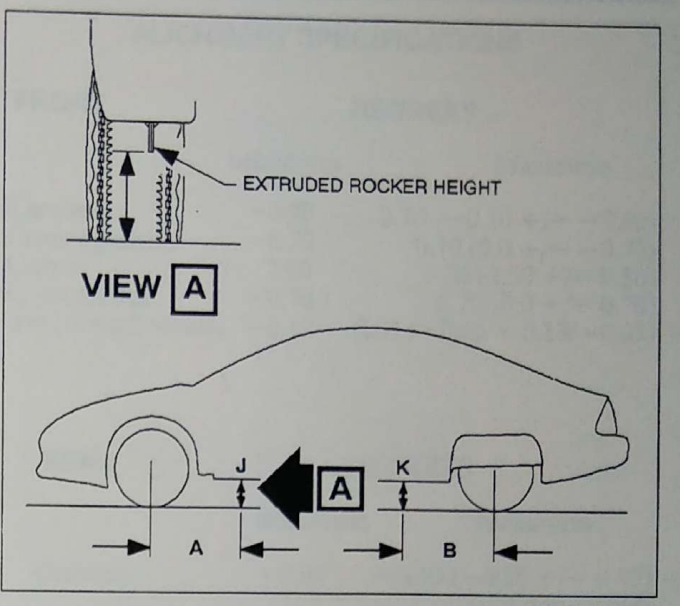
1. Check components for wear/damage.
   - Is the axle bent or damaged?
   - Is the wheel runout excessive? (Check wheel bearings, wheels and hub).
2. Check upper and lower suspension links.
   - Are bushings worn?
   - Are links damaged?
   - Are attachment points to axle or body damaged?
3. Check track bar assembly.
   - Are bushings worn?
   - Is track bar bent or damaged?
   - Is attachment points to axle or body damaged?
4. Check shock absorber.
   - Are bushings worn?
   - Is shock absorber bent or damaged?
   - Is shock absorber leaking fluid or binding?
   - Is attachment points to axle or body damaged?
5. Check coil springs.
   - Are coil springs sagged?
   - Is coil spring insulators located correctly?
6. Check trim height. Height must be correct before setting alignment.

MEASUREMENT AND SPECIFICATIONS

CURB TRIM HEIGHTS

IMPORTANT: When measuring alignment angles, it is critical that the vehicle trim height be correct! Measure and adjust trim height according to the following procedure before performing alignment.

1. Place vehicle on a level surface.
2. Remove rear wheel opening covers.
3. Adjust tire pressures to correct specifications.
   a. Adjust air pressure in all tires to 345 kPa (50 psi).
   b. Reset "Check Tire Pressure System." Depress the switch located on the underside of the rear compartment lid for more than one second.
4. Bounce front and rear suspension a few times to settle suspension.
5. Measure front and rear vehicle curb trim height.



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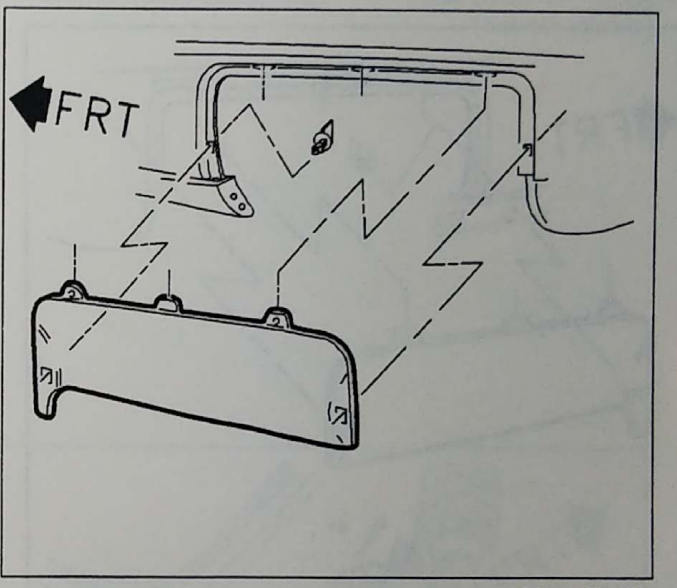
Measure from the center line of the front wheel rearward to obtain measuring point **"A."** Measure from the center line of the rear wheel forward to obtain measuring point **"B"** horizontal measurement. Measuring points **"J"** and **"K"** are the vertical measurement.

A	B
650 mm	550mm
(25.6 in)	(21.7 in)



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Measure the curb trim height from the level surface the vehicle rests on to the bottom horizontal surface of the extruded metal rocker. **Do not measure from the bottom of the rocker panel.**

Curb Trim Height:

J Front Extruded Rocker Height	K Rear Extruded Rocker Height
149.0 mm (5.87 in) – 183.8 mm (7.24 in) Nominal 166.4 mm (6.56 in)	160.0 mm (6.30 in) – 186.0 mm (7.32 in) Nominal 173.0 mm (6.82 in)

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ALIGNMENT SPECIFICATIONS

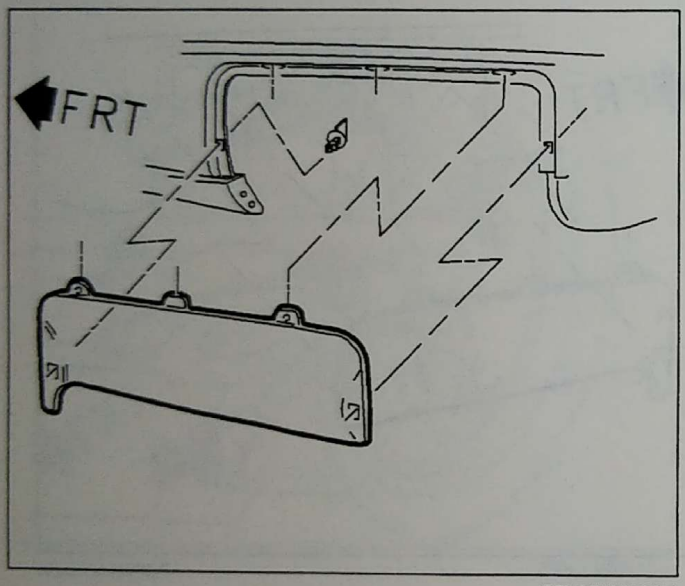
IMPORTANT: When measuring alignment angles, it is critical that the vehicle curb trim height be correct. If not correct, add or remove weight until trim height is correct. (Refer to "Curb Trim Heights" in this section.)

IMPORTANT: When performing a wheel alignment after any suspension system component removal and installation, the vehicle must be driven and/or the suspension system worked (manually jounced at least 20 times) to allow components to locate properly before alignment adjustment.

1. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this service manual.)
2. Place shifter in neutral and keypad in **OFF** mode.
3. Release park brake, if applied.
4. Remove rear wheel opening covers.
5. Adjust tire pressures to correct specifications
   a. Adjust air pressure in all tires to 345 kPa (50 psi). Reset check tire pressure system. Depress the switch located on the underside of the rear compartment lid for more than one second.
6. Install alignment equipment in accordance with the equipment manufacturers instructions.

NOTICE: If lifting of vehicle is required while the vehicle is on the alignment rack. Lift the front of vehicle using the front lower control arms. Place lifting pads on lower control arms between yoke attachment and lower ball joint. Lifting of the rear of vehicle using the rear axle. Place lifting pads under rear axle spring cups. Do not attempt to lift rear of vehicle using the center section of rear axle.

7. Check cradle for damage and alignment. Right rear cradle mounting bolt hole is slotted for alignment adjustment (cradle-to-body). If cradle to body alignment is not correct, loosen cradle fasteners and align cradle to body.
8. Measure alignment angles for each wheel.



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ADJUSTMENT

ORDER OF ADJUSTMENT

First: Check rear camber (not adjustable)

Second: Check rear toe (not adjustable)

Third: Front camber

Fourth: Front caster

Fifth: Front cross-camber

Sixth: Front cross-caster

Seventh Front toe

IMPORTANT: When performing a wheel alignment after any suspension system component removal and installation, the vehicle must be driven and/or the suspension system worked (manually bounced at least 20 times) to allow components to locate properly before alignment adjustment.

ALIGNMENT SPECIFICATIONS

FRONT

	DEGREES	
	Minimum	Maximum
Camber:	−0.90	0.70 (−0.10 +/− −0.80)
Cross Camber:	−0.70	0.70 (0.0 +/− −0.70)
Caster:	2.00	3.00 (2.50 +/− 0.50)
Cross Caster:	−0.70	0.70 (0.0 +/− 0.70)
Toe (at each wheel)	−0.12	0.08 (−0.05 + 0.13/−0.07)

REAR

	DEGREES	
	Minimum	Maximum
Camber:	−0.90	−0.10 (−0.50 +/− 0.40) (not adjustable)
Toe (at each wheel)	−0.30	0.30 (0.00 +/− 0.30) (not adjustable)

REAR WHEEL ALIGNMENT

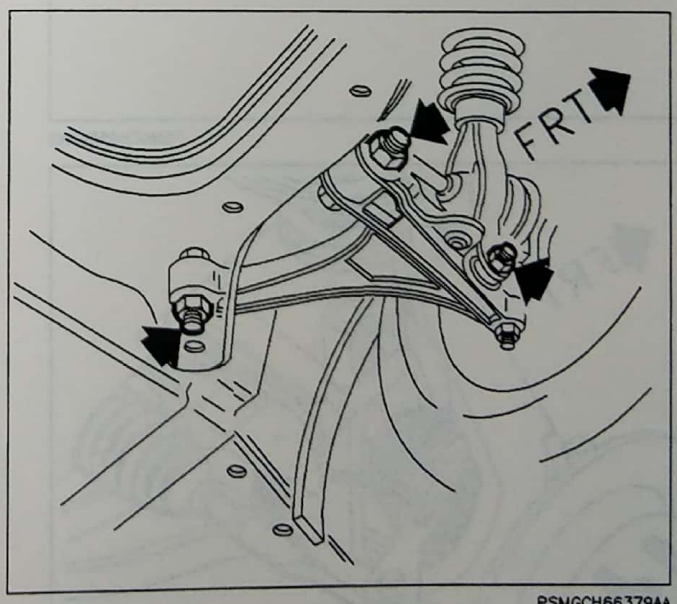
Rear wheel alignment involves checking two alignment angles (camber and toe). Rear wheel camber, toe and caster are not adjustable.

IMPORTANT: Rear wheel alignment must be within specifications before front wheel alignment is attempted.

FRONT WHEEL ALIGNMENT

FRONT WHEEL CAMBER/CASTER

1. Lock steering wheel in the straight ahead position.
2. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)
3. Loosen both lower control arm cam bolt assemblies.
4. Loosen yoke to lower control arm nut.



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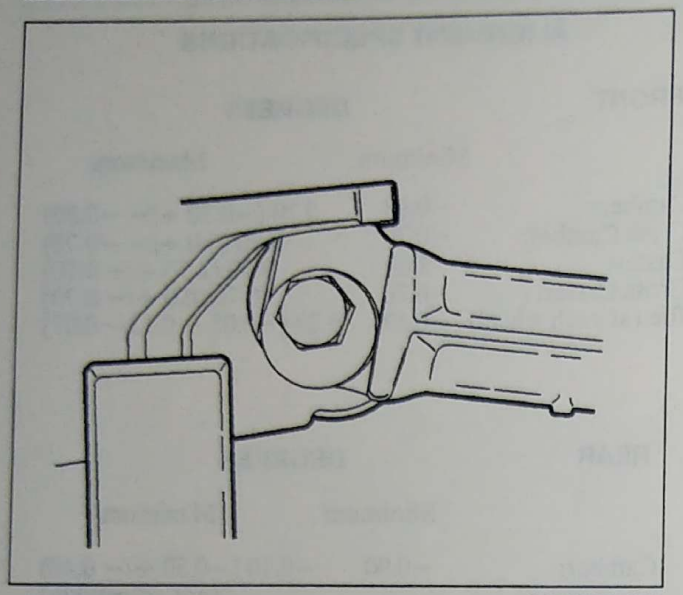

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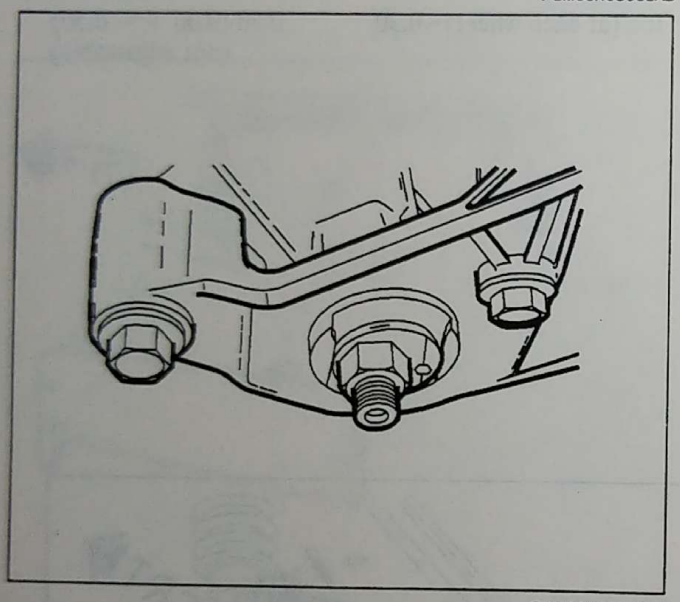
5. Rotate forward cam bolt at head (camber adjustment, specification −0.90 min., 0.70 max. degrees) in direction of desired change.
6. Rotate rear cam using a 6mm allen wrench (caster adjustment, specification 2.00 min., 3.00 max. degrees) in direction of desired change.



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7. Recheck camber and caster and readjust as necessary.
8. Tighten nuts on both lower control arm cam bolt assemblies.

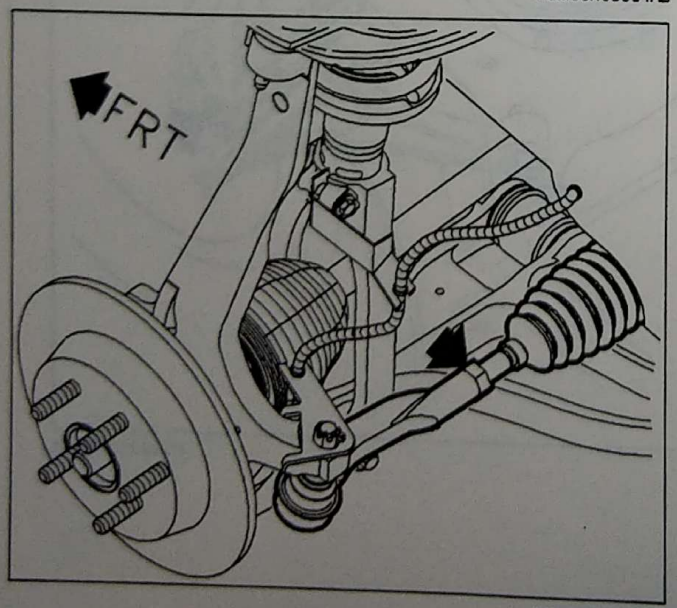
Torque: 150 N•m (111 ft−lbs)

9. Tighten yoke to lower control arm nut.

Torque: 150 N•m (111 ft−lbs)

10. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)

Torque: 6 N•m (53 in−lbs)



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FRONT WHEEL TOE

NOTICE: When performing the toe adjustment, the steering wheel must be locked in the straight ahead position.

1. Lock steering wheel in the straight ahead position.
2. Loosen left and right outer tie rod jam nuts.

NOTICE: Make sure that steering gear seals do not become twisted.

3. Adjust inner tie rods in the direction of desired toe change, toe adjustment, specification −0.12 min., 0.08 max. degrees.
4. After adjustment, tighten left and right outer tie rod jam nuts.

Torque: 65 N•m (48 ft−lbs)

5. Recheck toe angle. Adjust if necessary.

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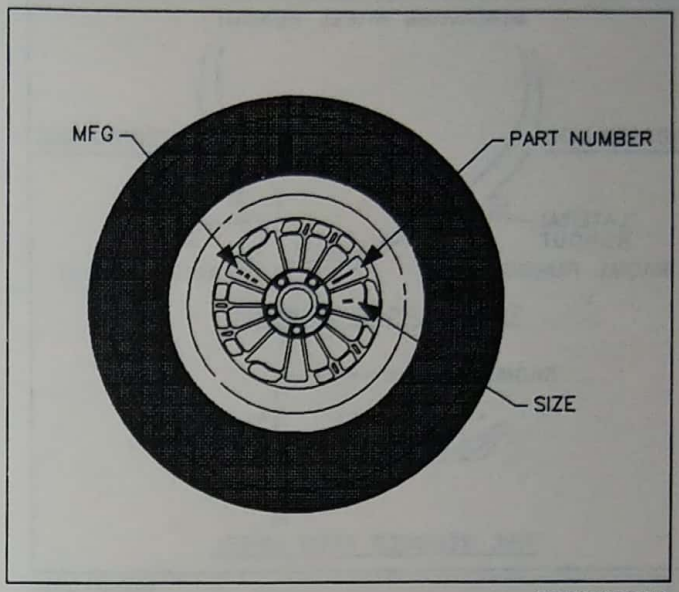
WHEELS

IDENTIFICATION

ALUMINUM WHEEL

Identification information for the aluminum wheels is located on the inside face of the wheel.



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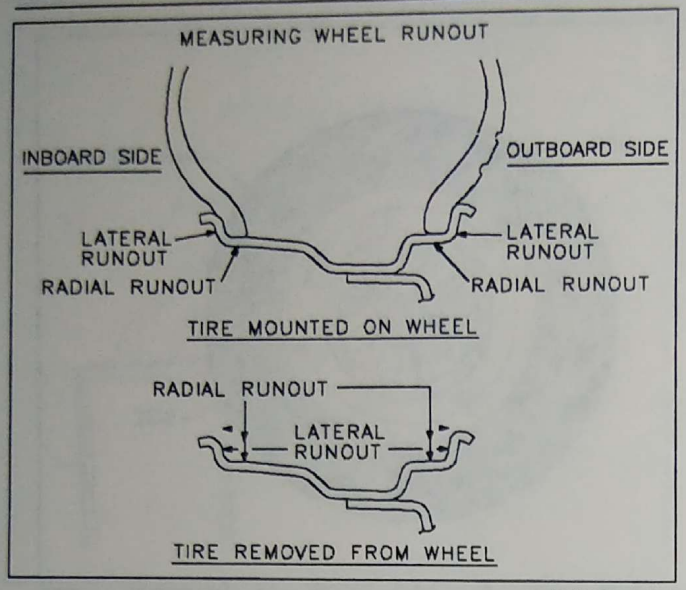

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WHEEL RUNOUT

MEASURING

Wheel runout should be measured with an accurate dial indicator. Measurements may be taken with the wheel installed on the vehicle (make sure wheel bearings do not have excessive free play) or off the vehicle on an accurate mounting fixture (such as a wheel balancing machine). Measure the radial and lateral runout of both the inboard and outboard rim flanges.

1. Place dial indicator in a rigid fixture and position against wheel.
2. Slowly rotate the wheel at least one full revolution while observing dial indicator.
3. Rotate wheel to position where the lowest dial indicator reading was observed.
4. Zero the dial indicator.
5. Slowly rotate the wheel one full revolution while observing dial indicator.
6. Record highest dial indicator reading. This is the wheel runout.

IMPORTANT: Disregard any indicator readings due to welds, scratches, paint runs, etc.

SPECIFICATIONS

	Radial Runout mm (in.)	Lateral Runout mm (in.)
Aluminum Wheel	0. 76 (0. 030)	0. 76 (0. 030)

REPLACEMENT

WHEELS

A wheel must be replaced if it:

a. Is bent or dented.
b. Has excessive lateral or radial runout.
c. Leaks air through its welds.
d. Has stretched or oblong fastener holes or fasteners will not stay on tight.
e. Is excessively corroded/rusted, particularly in the bead area.
f. Cracked.

Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim width, offset, and mounting configuration. A wheel of improper size or type may effect vehicle range, wheel and wheel bearing life, brake cooling, speedometer/odometer calibration, vehicle ground clearance, tire clearance to body and chassis, and may cause "Check Tire Pressure" light to come on.

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NOTICE: Do not mix wheels of different size or construction on the vehicle. Driving range and vehicle handling may be seriously affected and may result in a loss of control. This may also cause "Check Tire Pressure" light to come On.

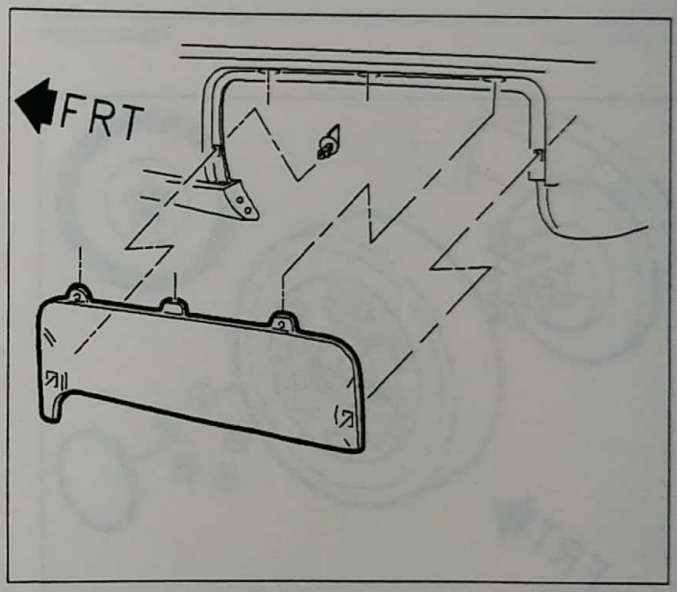
FASTENERS

NOTICE: Wheel fasteners are critical components. If fasteners are replaced with those of incorrect specification, vehicle damage can occur and vehicle safety can be compromised. Always replace wheel fasteners with either items of the same part number or fasteners that are known to be equivalent in design to those originally supplied on the vehicle.

SERVICE PROCEDURES

WHEEL REMOVAL

1. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. On rear wheel removal, remove rear wheel opening cover.



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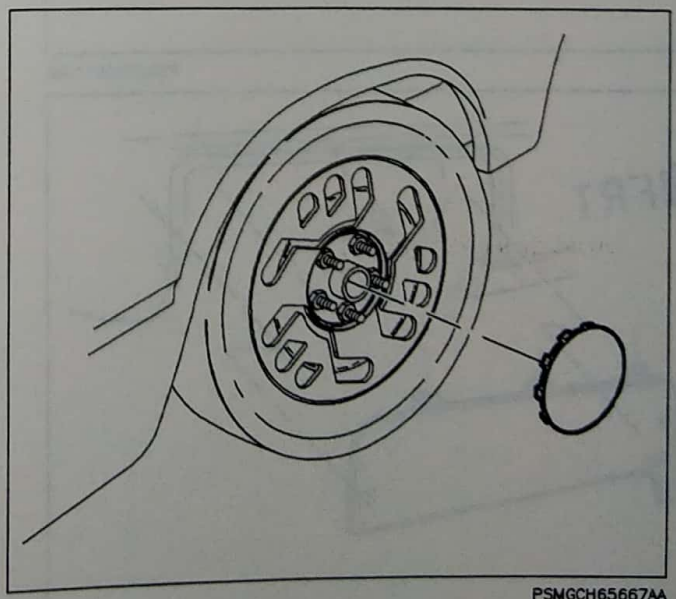
3. Remove wheel center cap.

NOTICE: Never use heat to loosen a tight wheel lug nut. This can shorten the life of the wheel and damage the wheel bearings.



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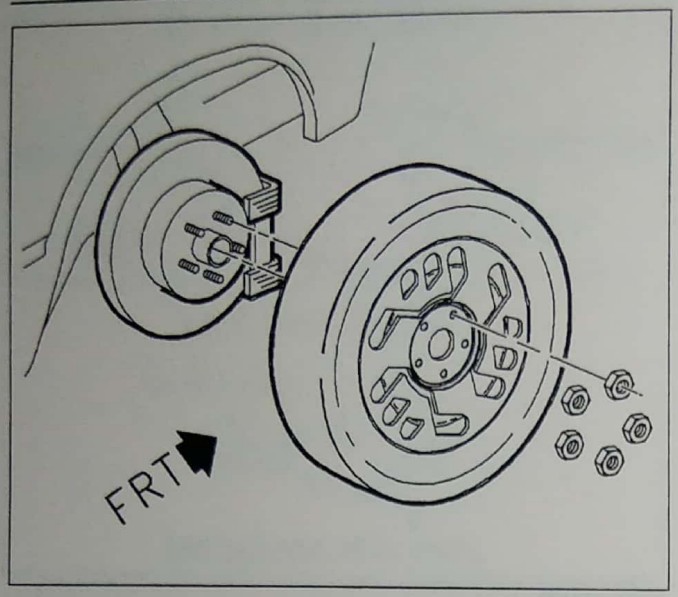

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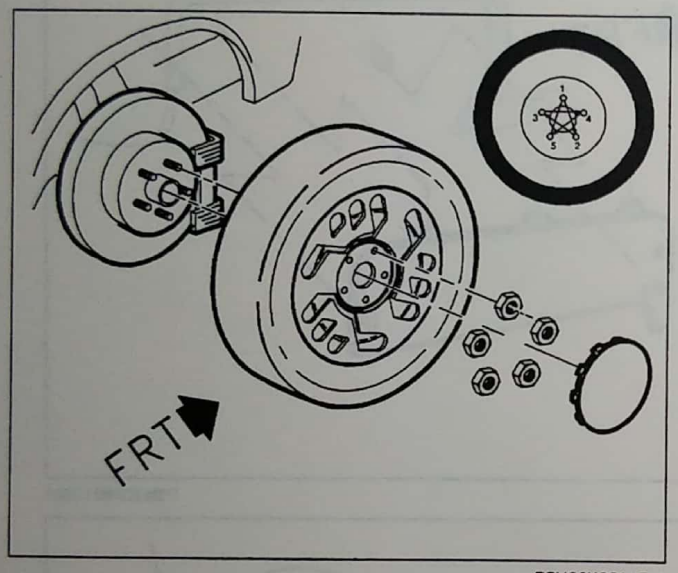
4. Remove wheel lug nuts.
5. Remove wheel.



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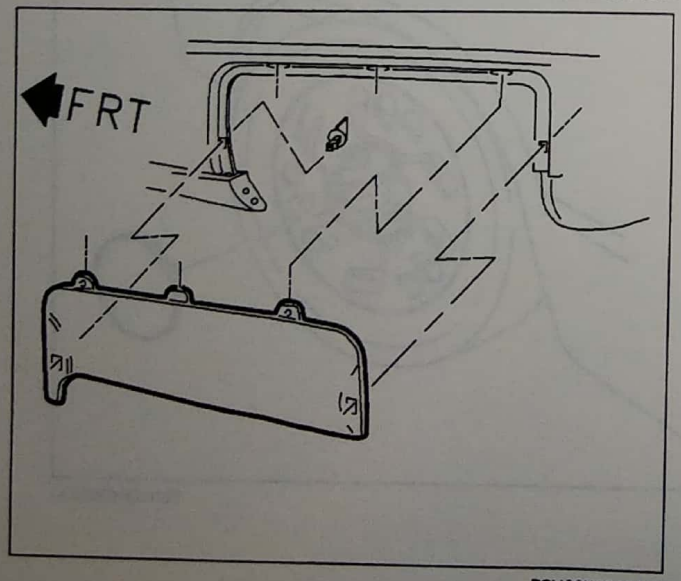
WHEEL INSTALLATION

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors/drums. Failure to do so can cause wheel lug nuts to loosen in service.

1. Position wheel onto hub.
2. Install wheel nuts and tighten in a star pattern. Repeat tightening pattern to be sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

3. Install wheel center cap onto wheel.



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4. On the rear wheels install rear wheel opening cover.
5. Lower vehicle from hoist.

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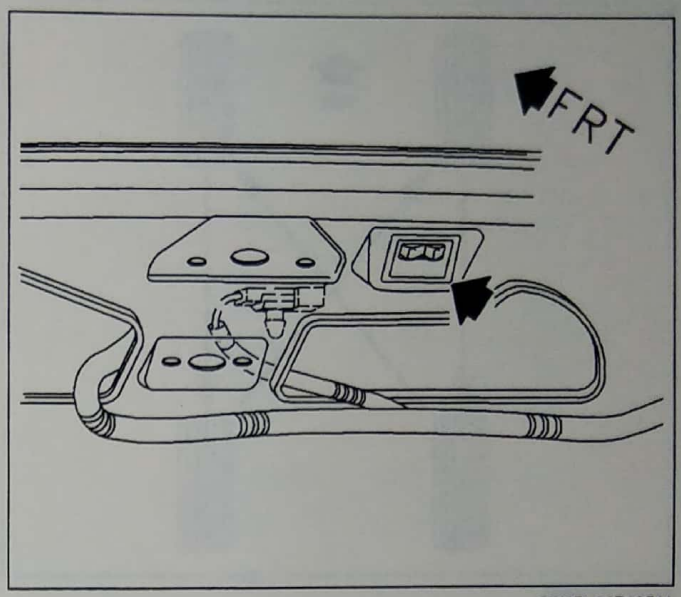
IMPORTANT: This vehicle is equipped with a "Check Tire Pressure System". This system must be reset following any tire service, such as pressure adjustments, tire rotation or tire replacement. To reset the system, depress the switch located on the underside of the rear compartment lid for more than one second.



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TIRES

GENERAL INFORMATION

The tires used on the EV1 are special, low rolling resistance tires, that contain a sealant material covering the tires inner liner in the tread area. These tires are specific to the EV1. No other type or style should be used.

All models are equipped with metric sized steel belted radial tires designed to operate satisfactorily with loads up to the full-rated load capacity, when inflated to the recommended inflation pressures.

Correct tire pressure, wheel alignment, and driving technique significantly influence tire life and vehicle driving range capabilities. Excessively heavy cornering, accelerating and braking will increase tire wear (decrease tire life) as well as lower the driving range capabilities.

CAUTION: NEVER USE OR INSTALL TIRE CHAINS. THEY CAN DAMAGE THE VEHICLE.

INFLATION PRESSURE

A check tire pressure monitoring system will cause the "Check Tire Pressure" light to come On if the air pressure in any tire loses 69 kPa (10 psi) or more. When all four tires are again at 345 kPa (50 psi), Reset "Check Tire Pressure System". Depress the switch located on the underside of the rear compartment lid for more than one second. This resets the "Check Tire Pressure System" using the current tire pressures as the new reference point. The "Check Tire Pressure System" should be reset any time tires are serviced or inflated.

For tire pressure and maximum tire load rating specifications, refer to the tire loading information sticker located on the rear edge of the driver's door. Refer to "Check Tire Pressure System" in the electrical service manual.

The metric unit for tire inflation pressure is the kilopascal (kPa), although inflation pressures are usually given in both kPa and psi. To convert between kPa and psi, use the following conversion formula:

1 psi = 6. 9 kPa

Maintaining the correct tire inflation pressure is essential to proper vehicle performance/range capabilities. The specified inflation pressure is carefully calculated to provide satisfactory ride, stability, precise steering, acceptable tire wear, and resistance to road damage.

Tire inflation pressure should be checked when the tires are cold. Cold tires are defined as tires on a vehicle that has not been driven for at least three hours or less than one mile.

It is normal for tire inflation pressure to increase **28 kPa (4 psi)** as the vehicle is driven distances more than one mile, as the tires heat up. Therefore, on a vehicle with warm tires, never correct tire pressure by letting air out of the tire; wait until the tire cools down to check and adjust tire pressure. Letting air out of a warm tire reduces the cold inflation pressure. Remember to reset "Check Tire Pressure System".

NOTICE: Tire valve caps must always be installed onto the tire valve to keep dirt and moisture out of the valve.

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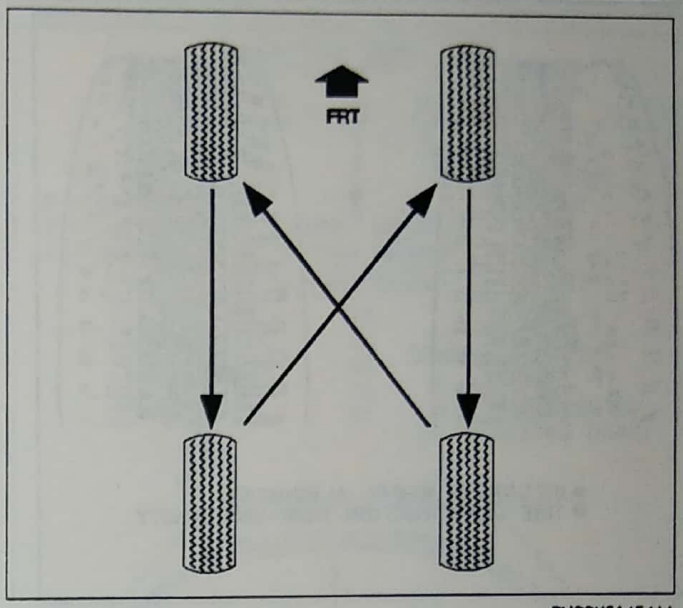
ROTATION

To equalize wear, rotate tires as shown. Tires should be rotated according to the Maintenance Schedule in the Maintenance section of the Owner's Handbook.

Maintenance Schedule recommends tire rotation at every 8,045 km (5,000 miles).

NOTICE: **Due to their design, radial tires tend to wear more quickly in the shoulder region of the tire (particularly when mounted on front wheels). Regular rotation of the tires at every 8,045 km (5,000 miles) is especially critical.**

NOTICE: **Reset "Check Tire Pressure System". Depress the switch located on the underside of the rear compartment lid for more than one second.**



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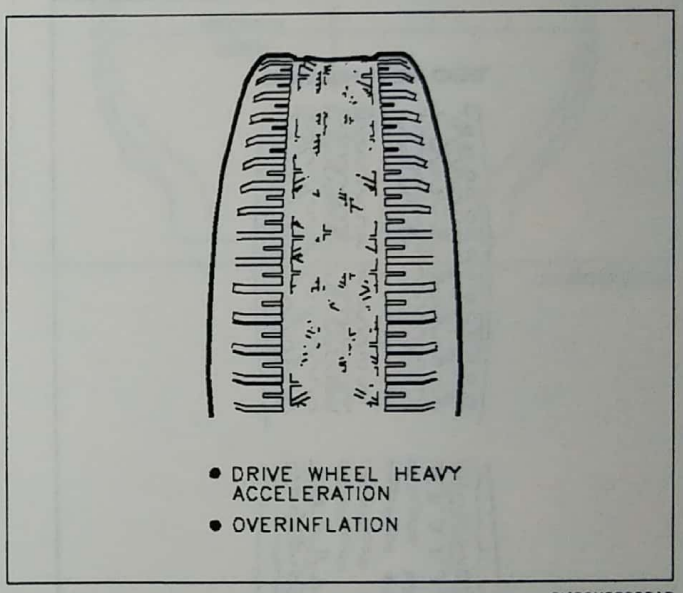
WEAR

Irregular and premature tire wear has many causes. Three of the most common being incorrect tire inflation pressure, incorrect wheel alignment, and lack of tire rotation. These conditions can often be diagnosed by visually inspecting the tire tread for the following telltale systems:

INCORRECT TIRE INFLATION PRESSURE

- Tread wear at center of tire (over-inflation).



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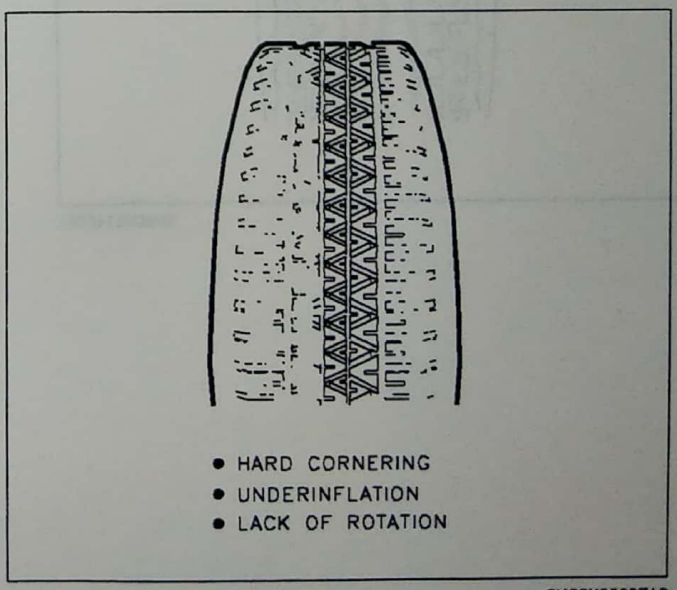
- Tread wear on edges of tire (under-inflation).



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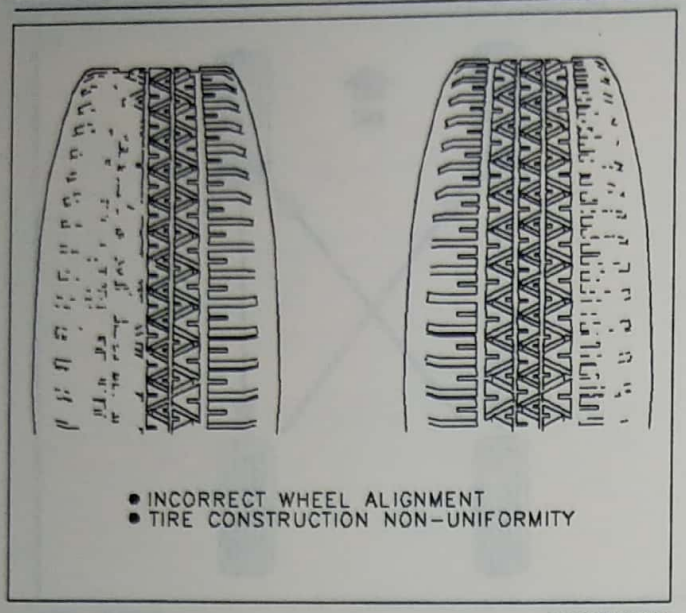

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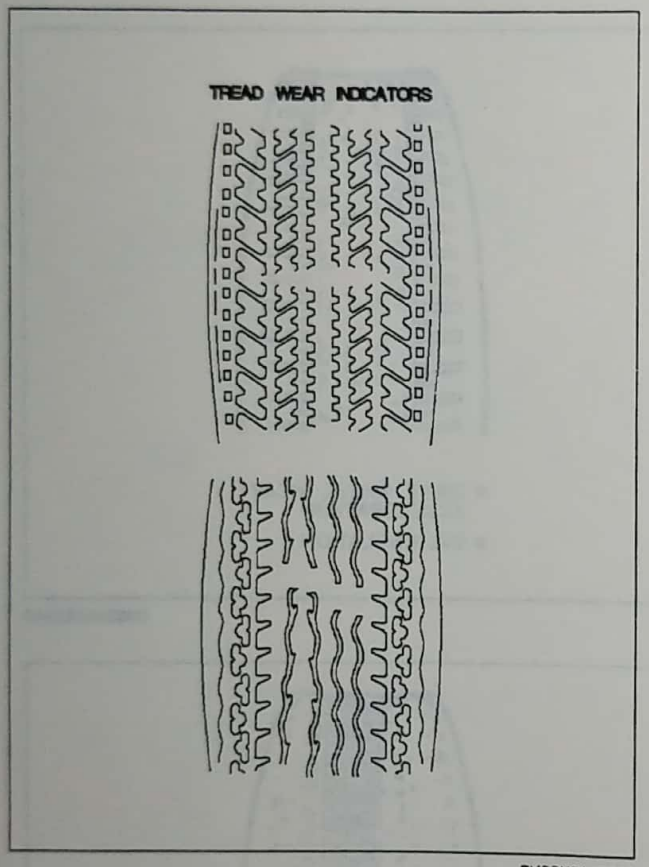
INCORRECT WHEEL ALIGNMENT

- Tread is worn on one side of the tire more than the other.
- Tread blocks have scuffed, feathered or cupped appearance.

LACK OF TIRE ROTATION

- Front tires worn more than rear tires.



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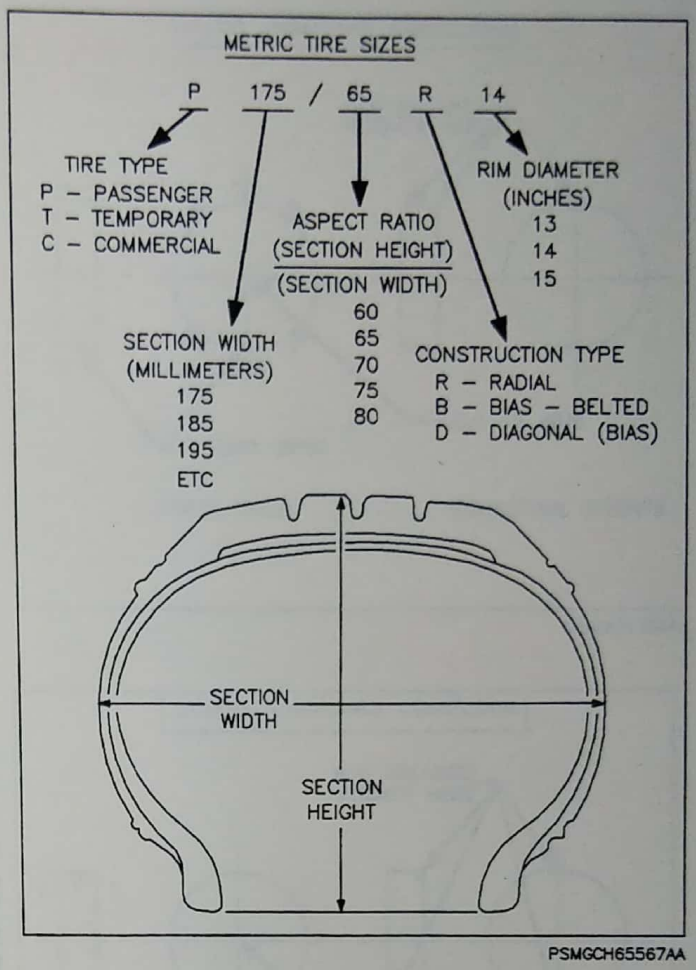
The original equipment tires specified for the EV1 have built in tread wear indicators to warn when tires need replacement. These indicators are wide bands located beneath the tread surface at the maximum tread wear depth. Tires are determined to be worn when the indicator band appears across two or more tread grooves at three locations about the circumference of the tire.

REPLACEMENT

The tires used on the EV1 are special, low rolling resistance tires that contain a sealant material covering the tires inner liner, in the tread area. These tires are specific to the EV1. All models are equipped with metric sized steel belted radial tires. The metric tire size format is shown in the illustration. When replacement is necessary, the original equipment type tire should be used. Refer to the tire loading information sticker on the rear edge of the driver's door.



Most metric tire sizes do not have exact corresponding alphanumeric tire sizes. Replacement tires should be of the same size, load range, and construction as those originally equipped with the vehicle. The use of any other size or type tire may affect vehicle range capabilities, ride and handling, speedometer/odometer calibration, vehicle ground clearance, tire to body or chassis clearance, and may cause "Check Tire Pressure" light to come On.

NOTICE: Do not mix tires of different size or construction on the vehicle. Vehicle handling may be seriously affected. A loss of control could occur.

It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with the tire having the most tread to equalize braking traction. Remember to reset "Check Tire Pressure System".

SERVICE PROCEDURES

TIRE REMOVAL

Use a tire changing machine to remove tires from the wheels. Follow the equipment manufacturers instruction.

NOTICE: Do not use hand tools or tire irons alone to dismount tires as they may damage the tire bead or wheel rim.

INSTALLATION

Use a tire changing machine to mount tires. Follow the equipment manufacturers instructions.

NOTICE: Do not use hand tools or tire irons alone to mount tires as they may damage the tire bead or wheel rim.

1. Clean rim bead seats with wire brush or coarse steel wool to remove lubricants, old rubber and light corrosion.
2. If required, install new tire valve stem.
3. Remove tire valve core.
4. Lubricate tire bead with an approved tire lubricant.
5. Install tire following equipment manufacturers instructions.
6. After installation, inflate tire to 345 kPa (50 psi). Check tire beads, to see if they are completely seated.

CAUTION: DO NOT EXCEED 345 kPa (50 PSI) PRESSURE WHILE ATTEMPTING TO SEAT TIRE BEADS. IF BEADS DO NOT SEAT UNDER THIS PRESSURE, DEFLATE TIRE, LUBRICATE BEAD AND ATTEMPT TO SEAT. DO NOT STAND OVER TIRE WHILE INFLATING. BEAD MAY BREAK WHEN SNAPPING OVER RIM SAFETY HUMP, AND CAUSE PERSONAL INJURY.

7. Install tire valve core.
8. Adjust tire inflation pressure according to tire loading information sticker located on the rear edge of the driver's door. Reset "Check Tire Pressure System". Depress the switch located on the underside of the rear compartment lid for more than one second.

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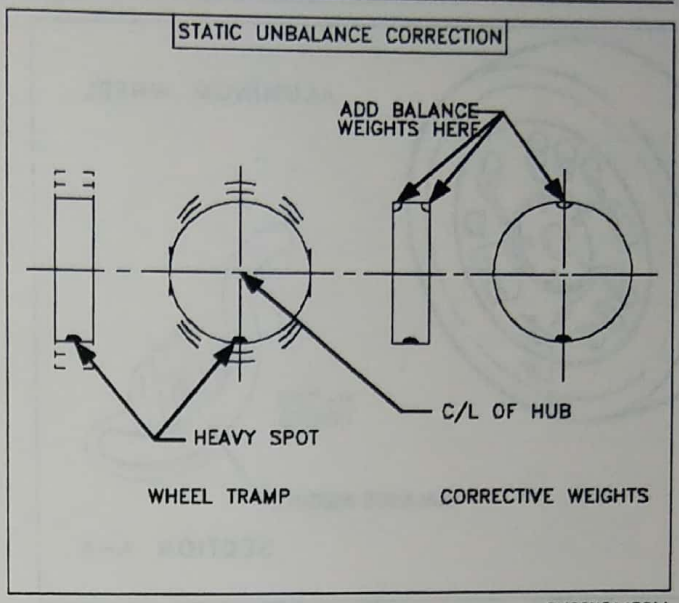
BALANCING

GENERAL INFORMATION

There are two types of wheel and tire balancing: static balancing and dynamic balancing.

Static balancing assures an equal distribution of weight around the wheel/tire. Assemblies that are statically unbalanced cause a bouncing action called tramp. This condition may cause vibration on smooth roads at highway speeds.



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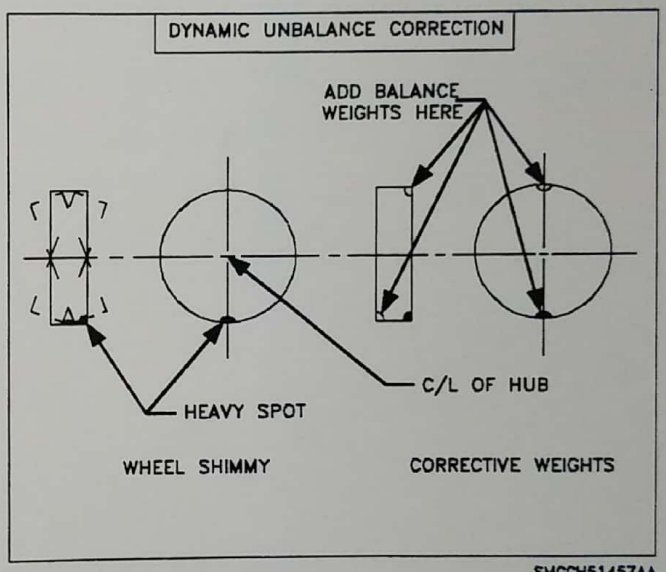
Dynamic balancing assures equal distribution of weight on each side of the wheel centerline, preventing the wheel from shaking from side-to-side and exhibiting a condition known as shimmy.

The two common methods of dynamic wheel balancing are off-vehicle balancing and on-vehicle balancing.

Off-vehicle balancing provides dynamic balancing and is more commonly used than the on-vehicle method.

On-vehicle balancing also provides dynamic balancing and is sometimes helpful in stubborn cases where the wheels, brakes, and/or hubs need to be balanced as a unit.



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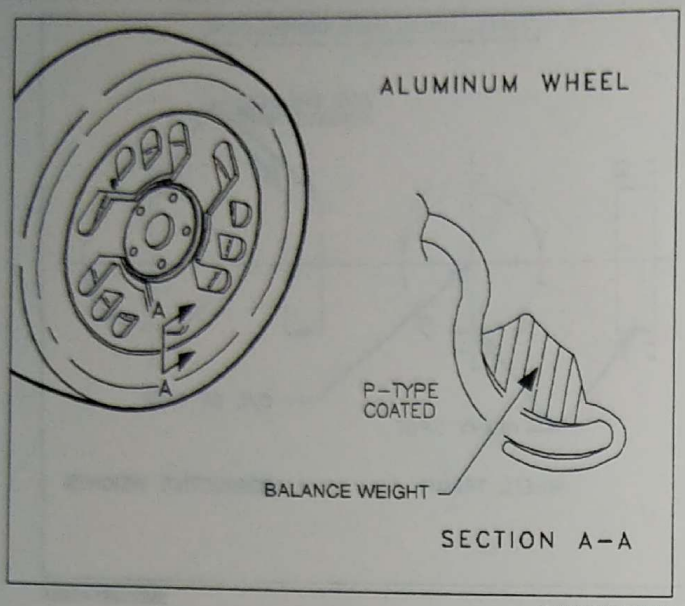

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GENERAL PROCEDURES

Wheel balancing methods vary according to the equipment manufacturers specifications. The following tips are only general information, and they are not intended to replace the procedures recommended by the equipment manufacturer.

Deposits of mud, dirt, etc. must be cleaned from the inside of the rim before attempting balancing.

CAUTION: STONES SHOULD BE REMOVED FROM THE TREAD TO PROVIDE ACCURATE WHEEL BALANCING AND TO AVOID OPERATOR INJURY (FROM STONES BECOMING DISLODGED WHILE WHEEL IS IN MOTION) DURING THE PROCEDURE.

CAUTION: WHEN BALANCING WHEELS ON A VEHICLE, LIMIT WHEEL SPEED TO AN INDICATED 56 KPH (35 MPH) IF WHEEL SPEED BECOMES EXCESSIVE, TIRE DISINTEGRATION OR DIFFERENTIAL FAILURE CAN OCCUR, POSSIBLY RESULTING IN PERSONAL INJURY.

Use only coated *P* type weights when balancing aluminum wheels.

NOTICE: Using uncoated wheel weights on aluminum wheels will cause unrepairable corrosive damage to the wheel.

TIRE REPAIR

There are many different materials and techniques on the market to repair tires, but not all work on some types of tires. Tire manufacturers have published detailed instructions on how and when to repair tires. The instructions can be obtained from the tire manufacturer.

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NOTES

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DRIVE AXLE (CHAX)

DIAGNOSIS

CAUSE/COMPLAINT CHART

COMPLAINT/CONDITION	POSSIBLE CAUSE(S)	CORRECTION(S)
Clicking noise in turn	Worn or damaged outer CV joint(s).	Replace drive axle.
Clunk when accelerating from coast-to-drive	Worn or damaged inboard tri-pot joint(s).	Replace drive axle.
Shudder or vibration during acceleration	Excessive joint angle:	
	Incorrect toe	Adjust toe
	Incorrect trim height	Correct trim height
	Worn or damaged inner or outer CV joint(s).	Replace drive axle.
Vibration at highway speeds	Out of balance wheel(s) or tire(s).	Balance wheel(s) or tire(s).
	Out of round wheel(s) or tire(s).	Replace wheel(s) or tire(s).
	Worn CV joint(s).	Replace drive axle.
	Binding or tight CV joint(s).	Replace drive axle.

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SERVICE PROCEDURES

DRIVE AXLE REMOVAL

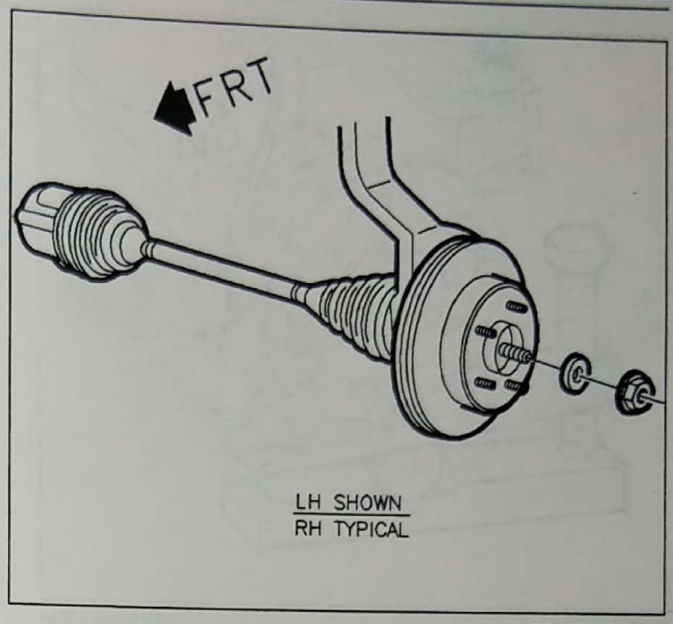
1. With vehicle on ground, remove wheel center cap, then depress brake pedal and loosen drive axle-to-hub nut.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

2. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
3. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
4. Remove road wheel corresponding to the drive axle being removed.
5. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)
6. Place approved container under gear box, to catch any fluid that may leak out upon drive axle removal (right or left side).
7. Remove drive axle nut and washer.
8. Remove front caliper and bracket and suspend it from the shock spring with safety wire.
9. Remove rotor.
10. Remove and discard lower ball joint to lower control arm cotterpin.
11. Loosen lower ball joint to lower control arm castle nut. Loosen castle nut to the point where the bottom of the castle nut is even with the bottom of the ball stud. Do not remove the castle nut at this time.

NOTICE: The outer CV joint has a speed sensor ring. Using the incorrect tool or procedure to separate the control arm from the knuckle can damage the ring, resulting in a loss of ABS operation. Even minor scratching of speed sensor ring may result in a loss of ABS operation.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal may be damaged.



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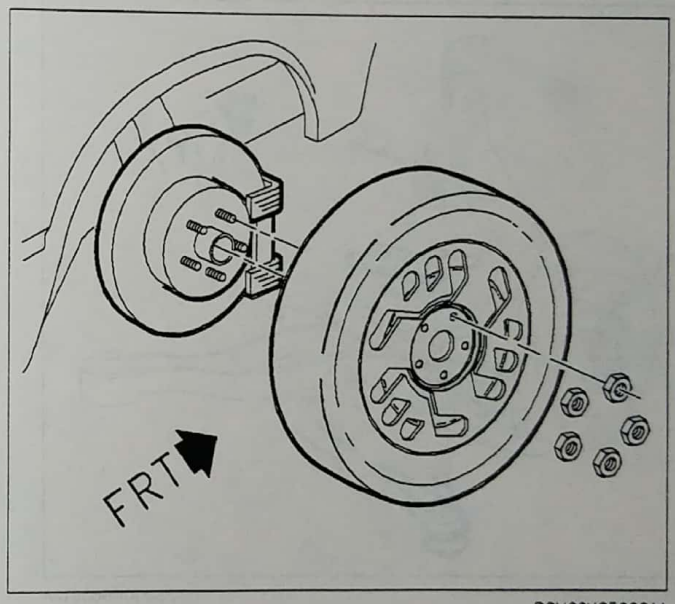

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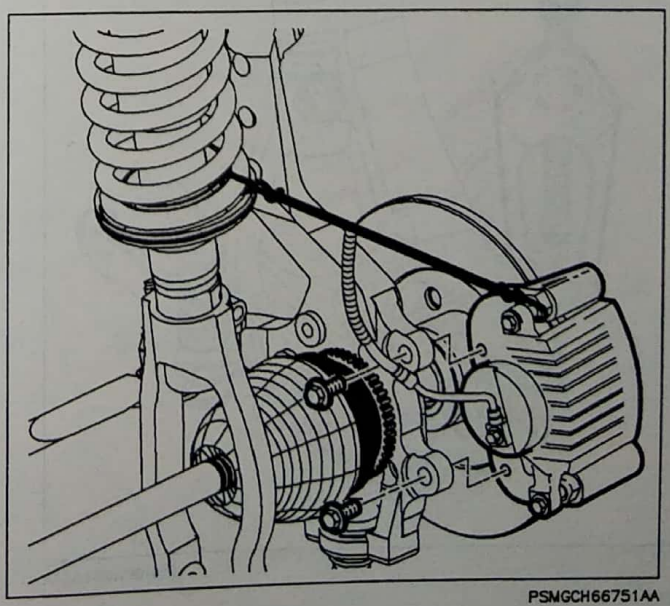

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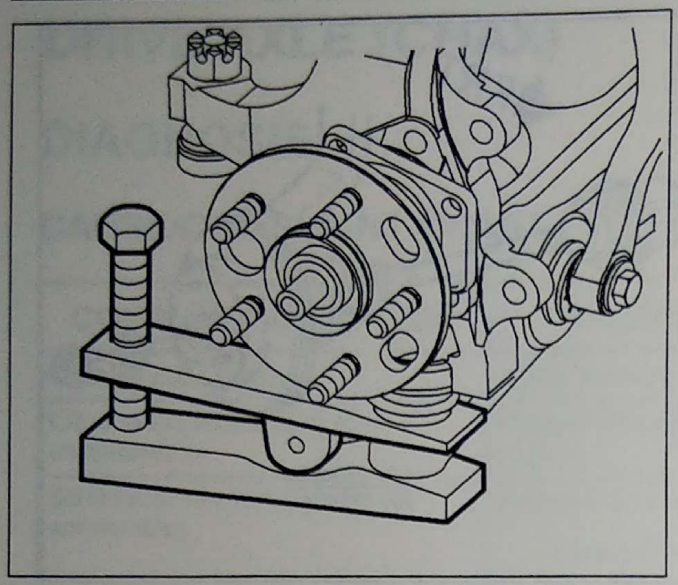

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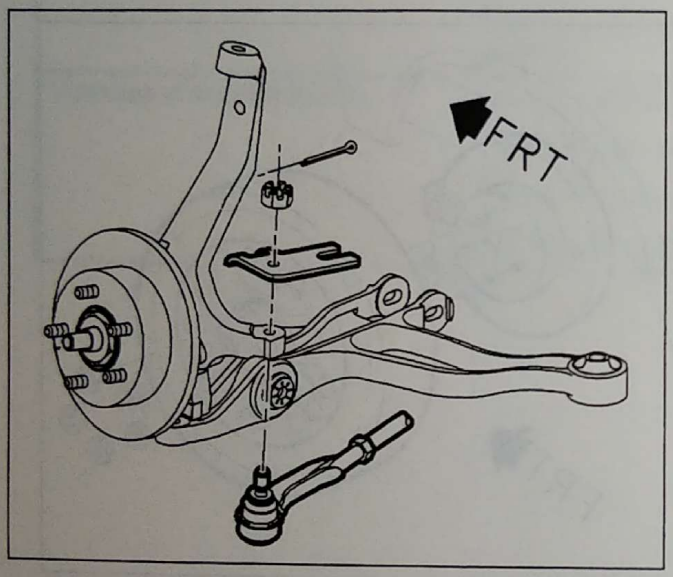
12. Use tool number SA9132S (or equivalent), separate lower control arm from steering knuckle.



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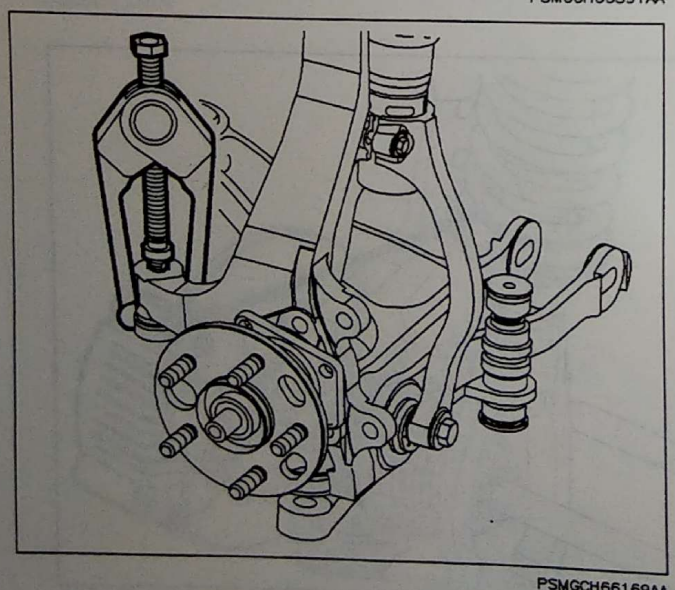
13. Remove and discard outer tie rod cotterpin.
14. Remove tie rod end castle nut and wire guide.



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NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal may be damaged.

15. Using tool number SA91100C (or equivalent), separate tie rod end from steering knuckle.
16. Remove lower ball joint to-lower control arm castle nut.

NOTICE: Be sure to use a cloth or cloths where the pry bar contacts suspension components to avoid surface damage to these components.

17. Separate lower ball joint from lower control arm by prying down on lower control arm and pulling the steering knuckle away from the lower control arm.

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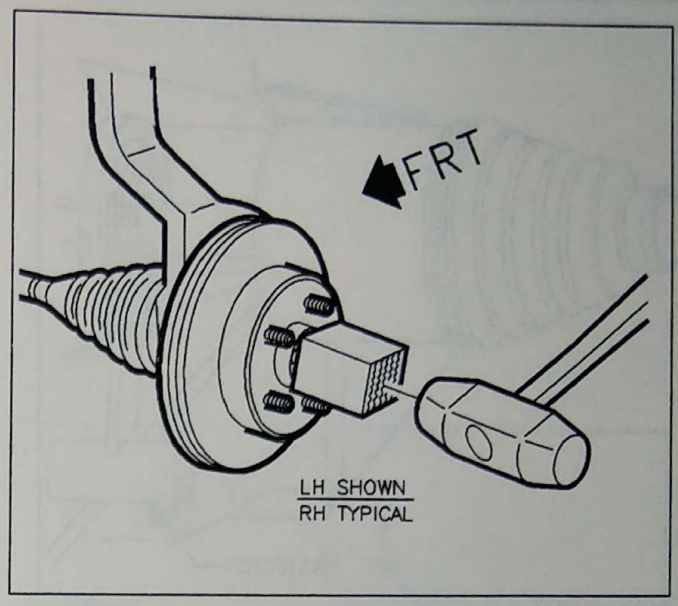
NOTICE: Be careful not to allow contact with ball joint boot. Contact may cause the boot to rip, requiring replacement of steering knuckle.

NOTICE: To prevent damage to the CV joint boots, be careful not to allow them to contact other parts during the removal/installation process. Also, never pull on the shaft assembly.

18. While pulling steering knuckle assembly away from vehicle, pull outer end of drive axle out of the wheel hub.

IMPORTANT: If difficulty is encountered in separating axle from hub, tap on end of drive axle shaft, using a block of wood and a hammer. Do not hammer directly on end of axle.

19. Support or suspend drive axle assembly.



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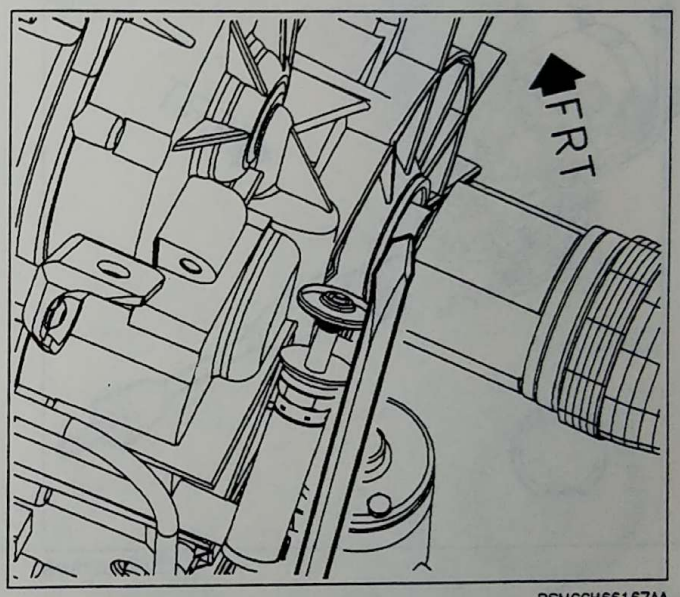
NOTICE: When inserting screwdriver or pry bar between the gearbox and drive axle, be careful not to contact gear box oil seal. Contacting the gearbox oil seal can damage the seal, requiring seal replacement.

20. For either left or right side drive axle, remove axle by inserting a large screwdriver or pry bar into the correct location and pry axle out of gearbox.

21. Remove drive axle from vehicle.



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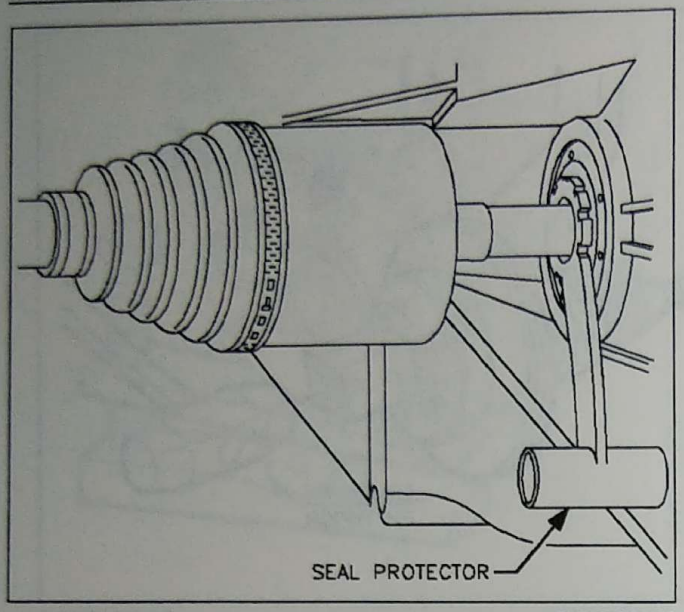

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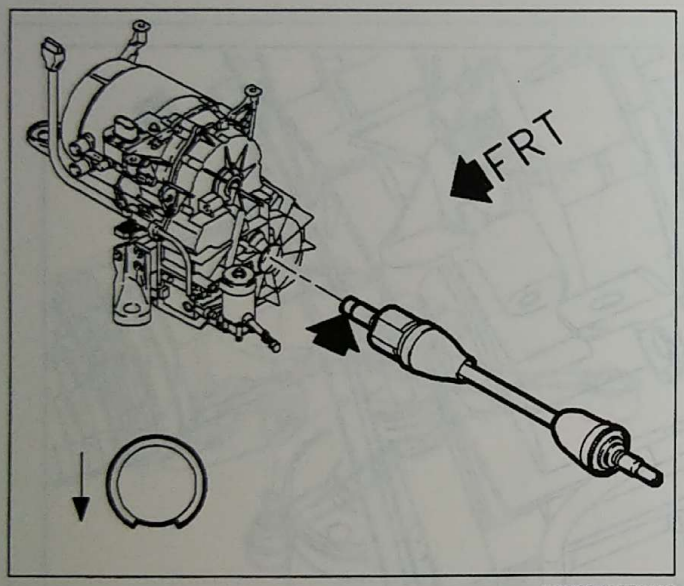

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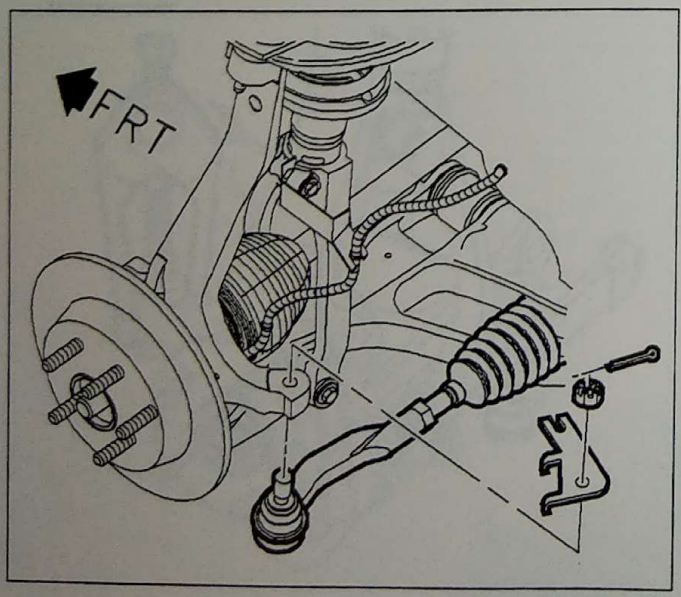

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DRIVE AXLE INSTALLATION

NOTICE: When inserting drive axle into gearbox, be careful not to contact oil seal with drive axle splines. The splines can damage the oil seal.

1. Install gear box seal protector SA91112T (or equivalent).

IMPORTANT: Make sure drive axle clip is oriented with opening facing downwards prior to installation into gearbox.

2. Insert drive axle into gearbox.
3. After drive axle splines have safely passed the gearbox oil seal remove seal protector, fully seat drive axle into gearbox.

NOTICE: To prevent damage to the CV joint boots, be careful not to allow them to contact other parts during the removal/installation process. Also, never pull on the shaft assembly.

4. Insert outer end of drive axle into the wheel hub. Do not install drive axle-to-hub washer or nut at this time.

NOTICE: Be careful not to allow the lower control arm to contact ball joint seal (boot). Contact may cause the seal to rip, requiring steering knuckle replacement.

5. Install lower ball joint into lower control arm. Install ball stud castle nut.

IMPORTANT: Do not tighten fastener at this time.

IMPORTANT: The rod end threads must be thoroughly cleaned.

6. Attach tie rod end and wire guard to steering knuckle with castle nut and a new cotter pin.

Torque: 23 N•m (17 ft−lbs)

IMPORTANT: If necessary to rotate the castle nut after tightening to align it with the hole in the stud, always tighten the nut to align it; never loosen it.

IMPORTANT: Steering knuckle ball threads must be thoroughly cleaned.

7. Tighten ball joint stud castle nut and install new cotter pin.

Torque: 10 N•m (88 in−lbs) + 120 degrees

IMPORTANT: If it is necessary to rotate the castle nut after tightening to align it with the hole in the stud, always tighten the nut to align it; never loosen it.

8. Install brake rotor onto wheel hub.
9. Install front brake caliper and mounting bracket.

Torque: 110 N•m (81 ft−lbs)

NOTICE: Use new nut; torque retention of old nut may not be sufficient.

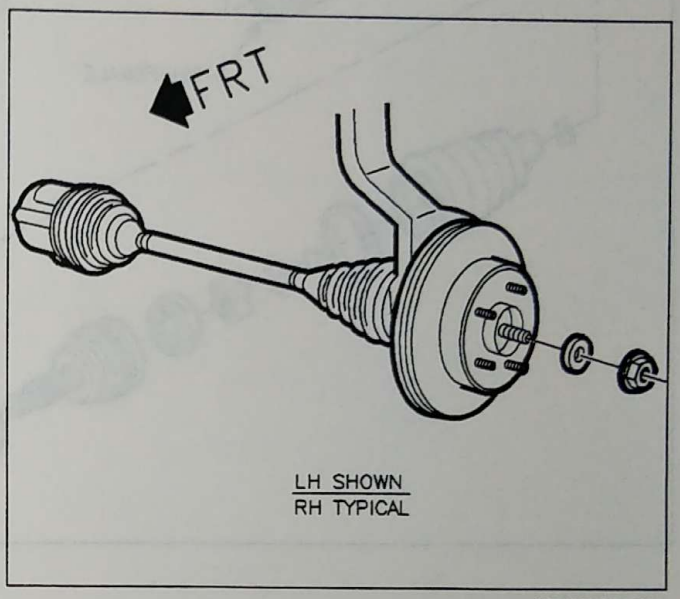
10. Install axle-to-hub washer and **NEW** nut.

Torque: 260 N•m (192 ft−lbs)

IMPORTANT: When tightening axle nut, have a helper depress brake pedal to prevent axle rotation.

11. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this service manual.)

Torque: 6 N•m (53 in−lbs)



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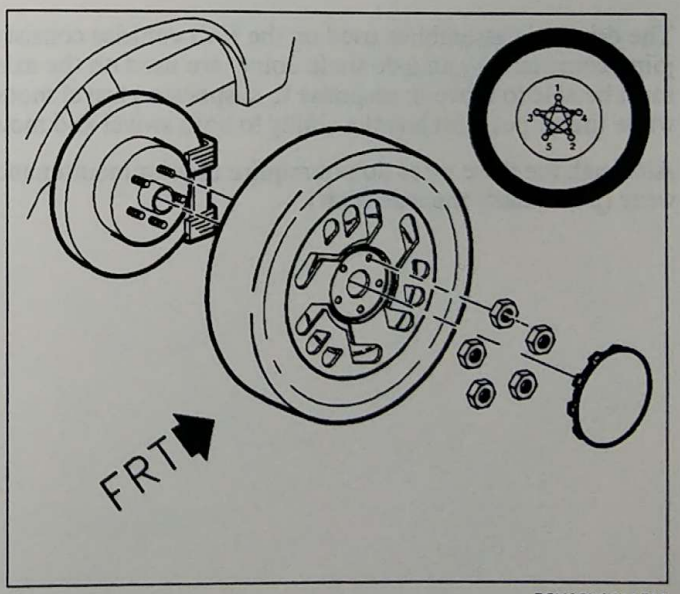
NOTICE: Before installing wheels, remove any rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

12. Position wheel onto hub.
13. Install wheel nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

14. Install wheel center cap.
15. Lower vehicle from hoist.
16. Check gearbox for correct level of lubricant, if necessary, fill to proper level.
17. Enable high voltage. (Refer to "High Voltage Enable" procedure in this manual.)



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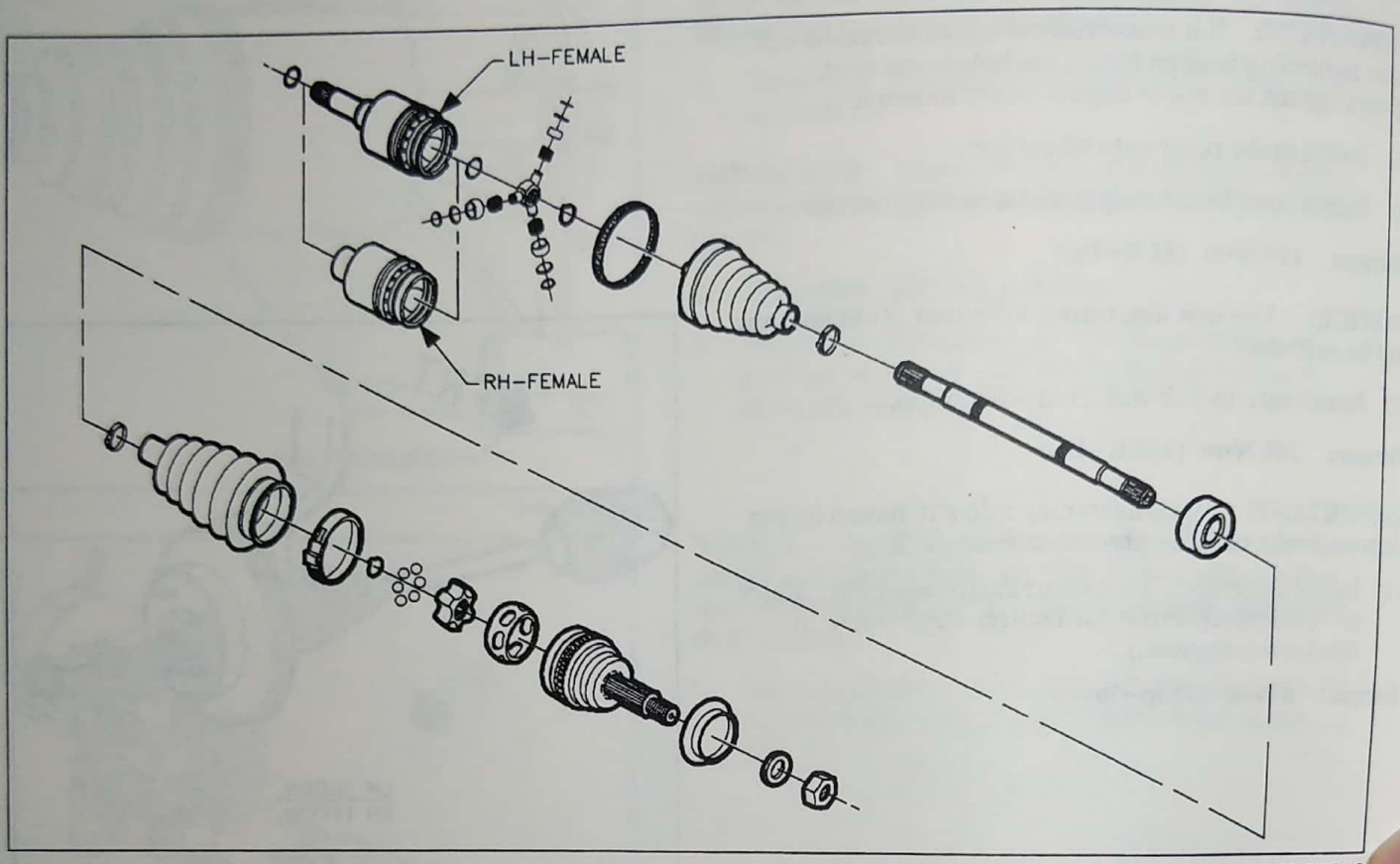
GENERAL DESCRIPTION



The drive axle assemblies used on the EV1 vehicles consist of a tri-pot joint and an outer constant velocity (CV) joint, connected by an axle shaft. Joints are used on the axle shafts to provide flexibility, since the axle assemblies must be able to move in response to suspension travel motion and steering inputs. The outer CV joint can swivel, while the tri-pot joint has the ability to both swivel and move in and out.

Although the drive axles do not require regular maintenance, they should be inspected periodically for damage and wear (particularly the axle seals).

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NOTES

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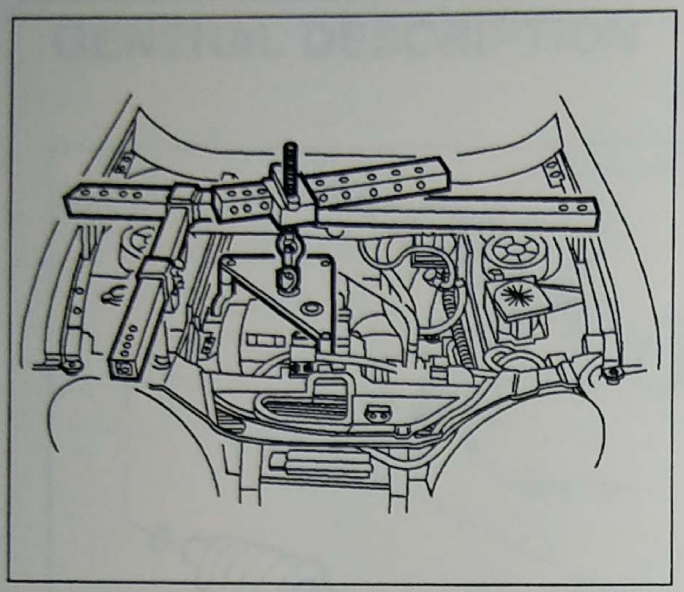

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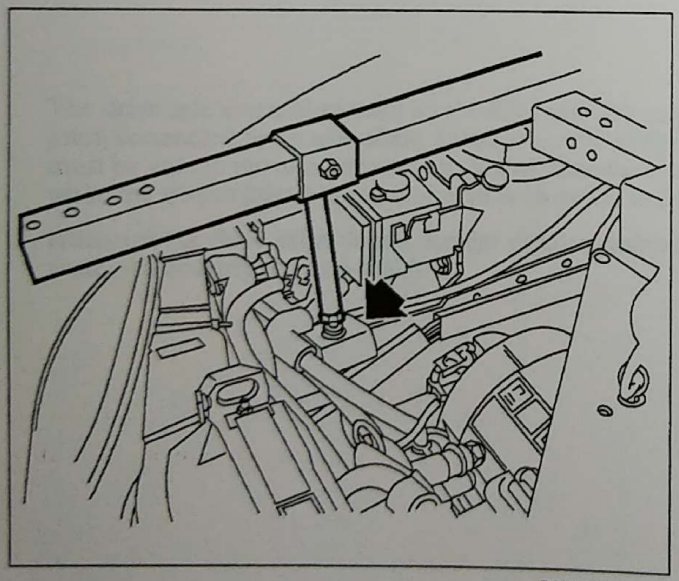
CROSSMEMBER – DRIVETRAIN AND FRONT SUSPENSION (CRADLE)

CRADLE

REMOVAL

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Remove the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Removal" procedure in this manual.)
2. Install drive motor support plate EV9711E (or equivalent).
3. Install drive motor support bar assembly SA9105E (or equivalent).
   a. Assemble support bar using EV9708E adaptor kit (or equivalent).



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IMPORTANT: The cross bars on the drive motor support bar fixture have more than one setting. Make sure the attachment pin and hooks are installed in the proper location to prevent damage.

   b. Place drive motor support bar in vehicle as shown. Place the support bar feet on the outer edge of the shock tower.
   c. Connect bar hooks to drive motor support plate.
   d. Position stabilizer foot per illustration.
   e. Adjust hook and stabilizer to remove looseness.

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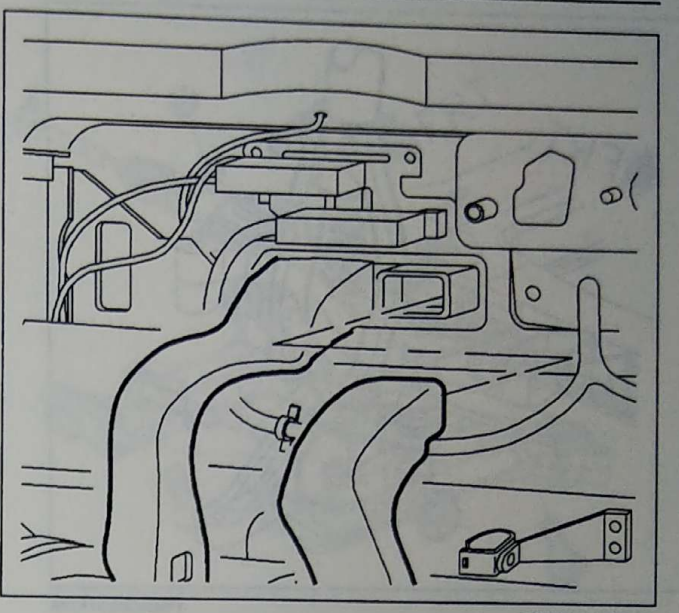
4. Remove upper portion of left air outlet duct.
5. Unseat lower portion of brake pressure modulator splash shield and position away from modulator.
6. Disconnect brake pressure modulator assembly from cradle. Support unit in installed position by strapping unit to side rail. If unit is properly supported, there will be no need to disconnect any fluid lines.
7. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
8. Remove brake pressure modulator splash shield.
9. Remove front wheels.



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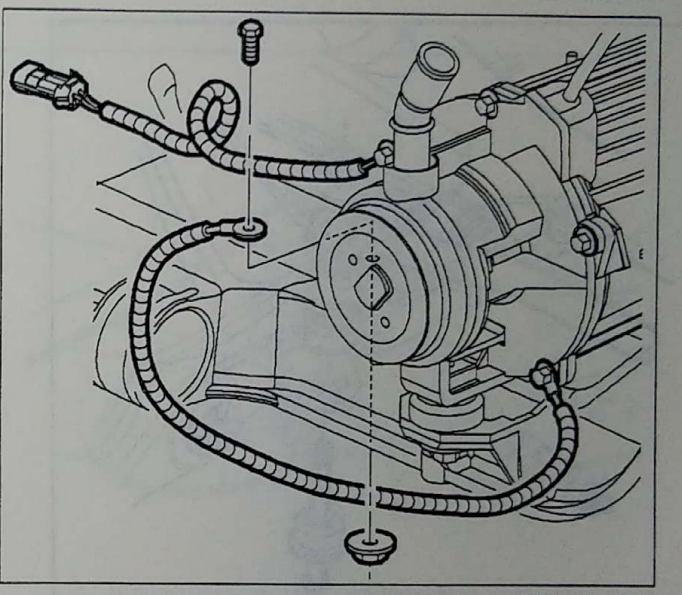
10. Remove push pins from left air outlet duct and push upwards to allow access to rear motor mount nut.
11. Remove rear drive motor mount bolt.
12. Disconnect assembly clips holding cooling lines to cradle.
13. Disconnect power steering pump/motor ground wire from cradle.
14. Disconnect power steering pump/motor ground sensing harness connector.



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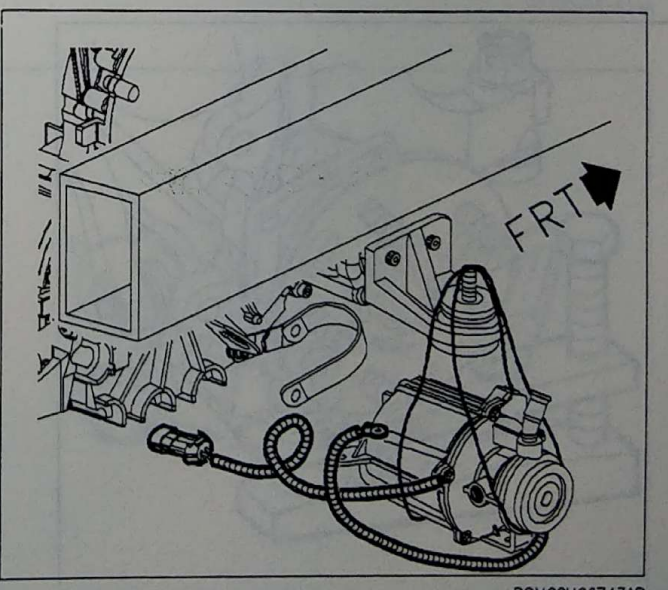
15. Disconnect power steering pump/motor from cradle. Support motor/pump in the installed position by strapping pump to right side motor mount bracket. If the pump/motor is properly supported, there will be no need to disconnect any fluid lines.



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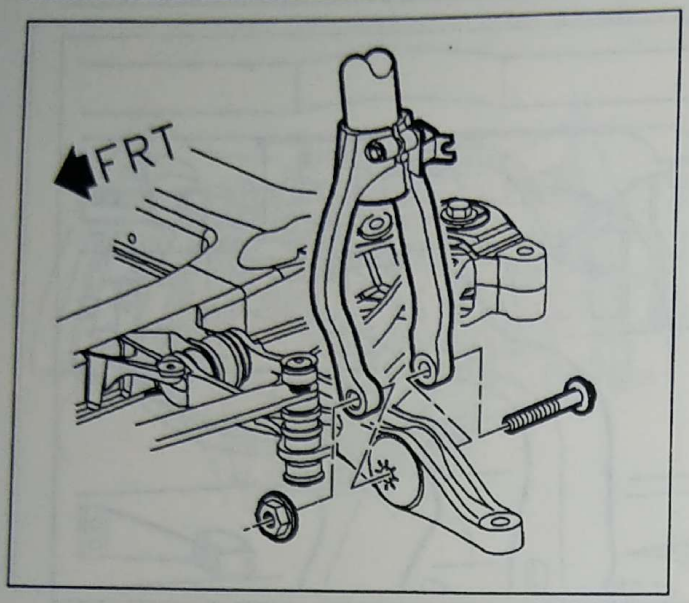

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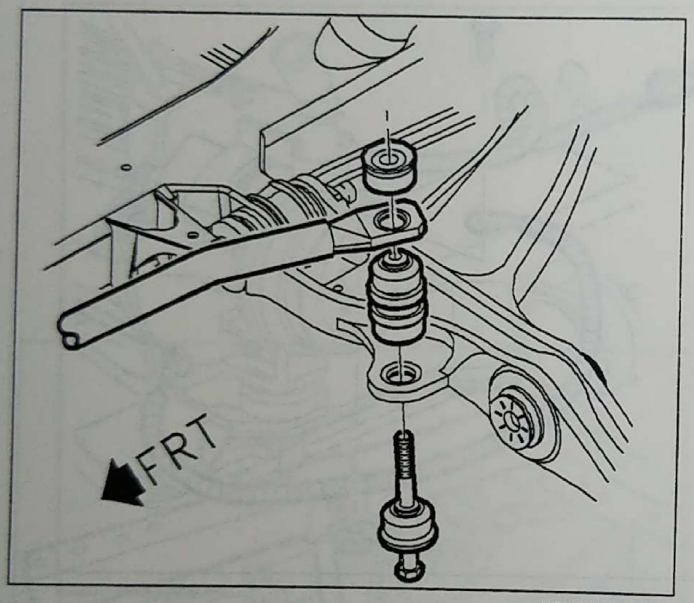
16. Disconnect front yoke from lower control arm, both sides.



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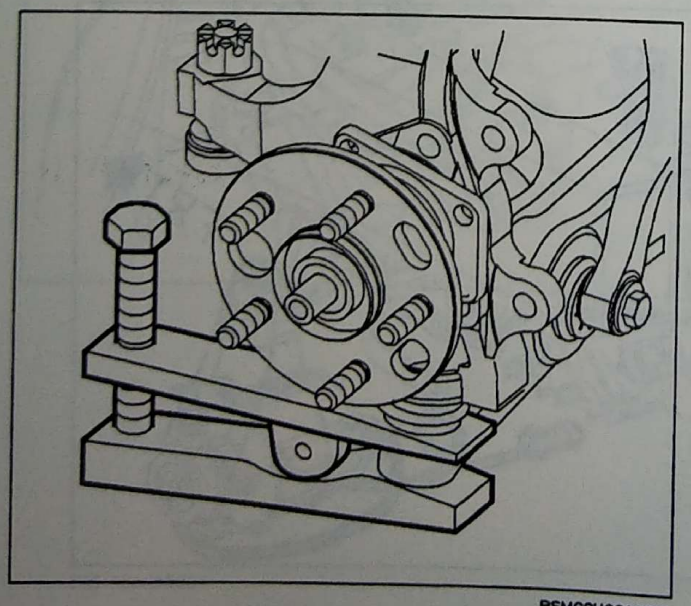
17. Remove front stabilizer shaft link from lower control arms, both sides, using EV9716S Front Stabilizer Link Socket (or equivalent).
18. Remove and discard lower steering knuckle ball stud cotter pin.
19. Loosen lower steering knuckle ball joint stud castle nut, until the bottom of castle nut is level with the bottom of ball stud.

NOTICE: Care must be taken to prevent damage to the speed sensor ring. Minor surface damage to the speed sensor ring can result in ABS system malfunctions.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal on the lower ball joint may be damaged.



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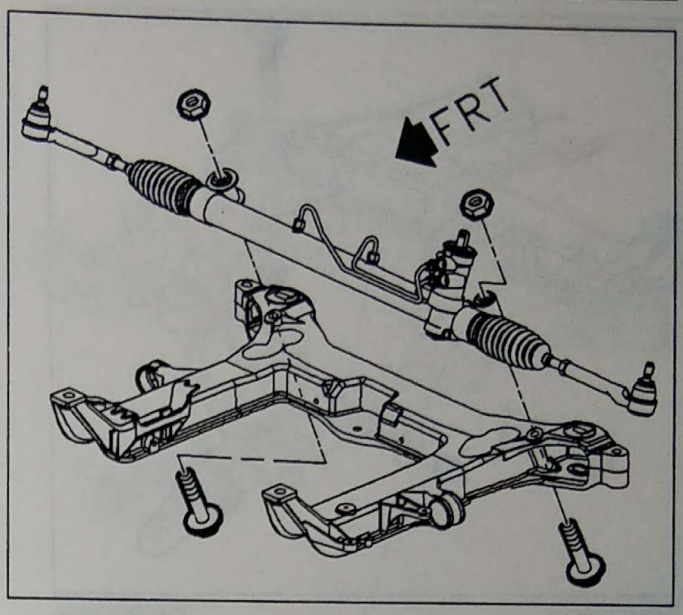
IMPORTANT: It may be necessary to support upper control arm and knuckle assembly to prevent any damage to components.

20. Using SA9132S (or equivalent), separate steering knuckle from lower control arm.

NOTICE: Lubricate threads of tool forcing screw often, using thread lube.

21. Remove lower control arm ball stud castle nut.

22. Disconnect steering gear from cradle and support in installed position.



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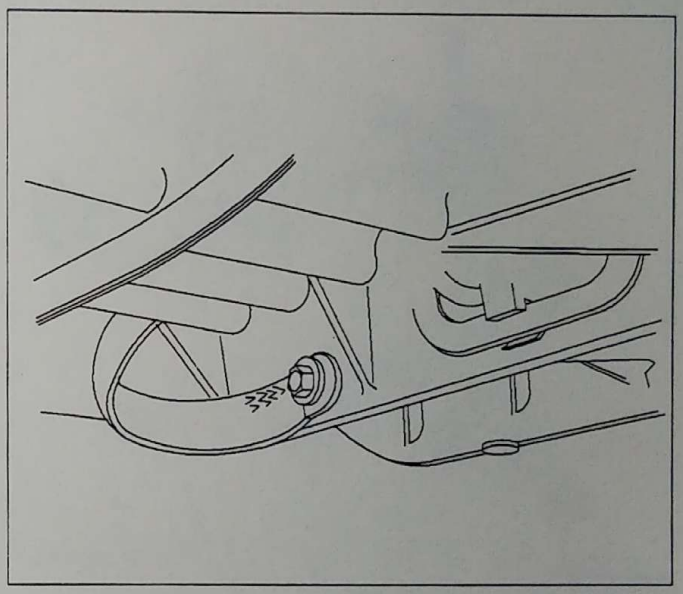
23. Remove drive motor ground strap from cradle end.



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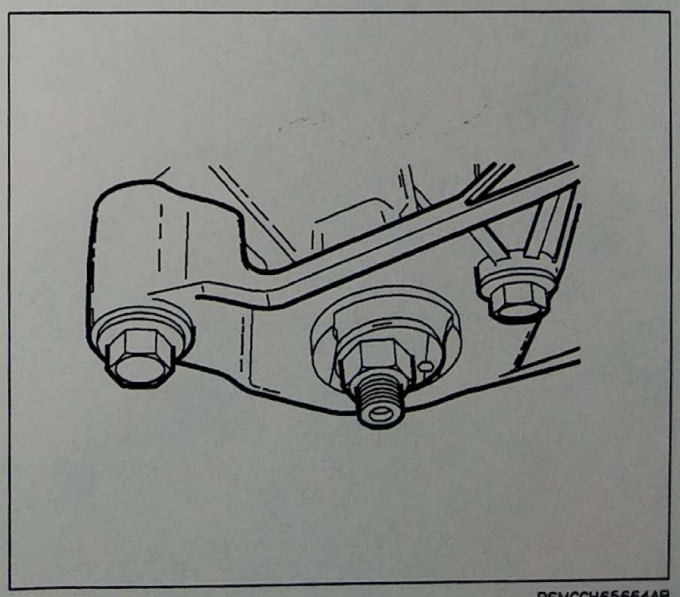
IMPORTANT: Mark original position of cam adjusters before removal. This will ease in alignment procedures later.



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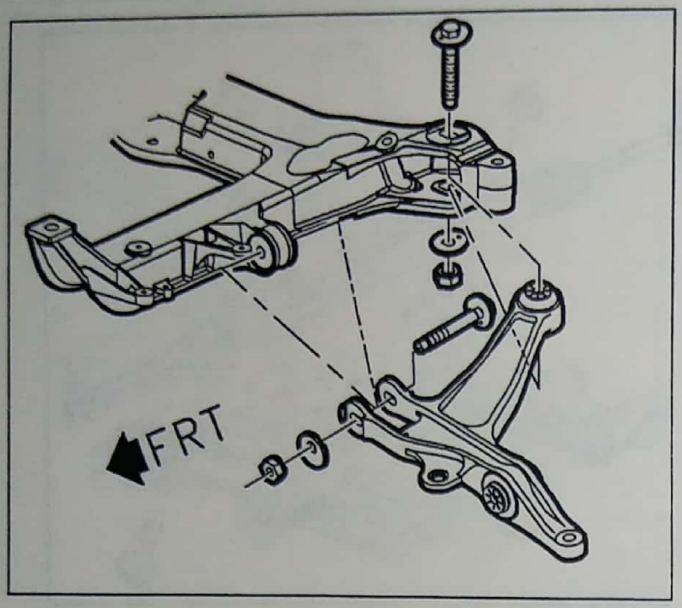

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24. Remove front lower control arm-to-cradle cam bolt assemblies.
25. Remove four cradle-to-body attachment fasteners and using a support dolly and two 4 in. x 4 in. x 36 in. pieces of lumber to support the cradle on the dolly.
26. Lower cradle to a point where rear lower control arm cam bolt assemblies can be removed. Remove bolts and seperate/remove lower control arms from cradle.
27. Carefully remove cradle from vehicle.

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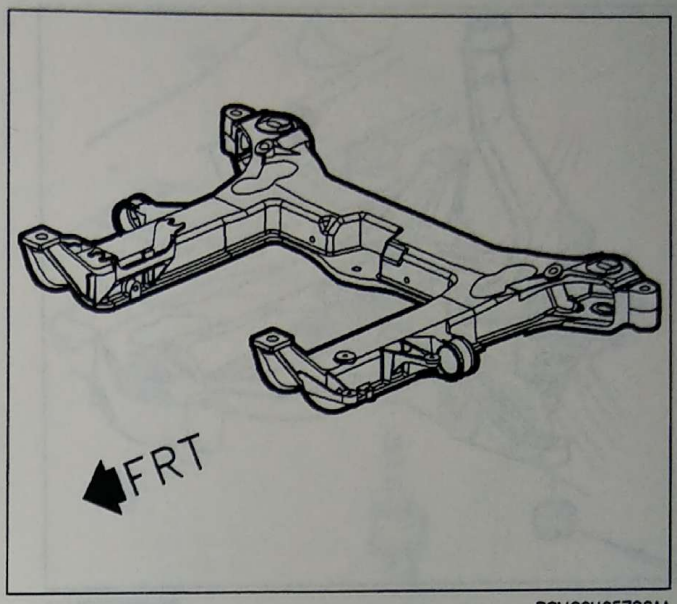
INSTALLATION

1. Install lower control arms to cradle.



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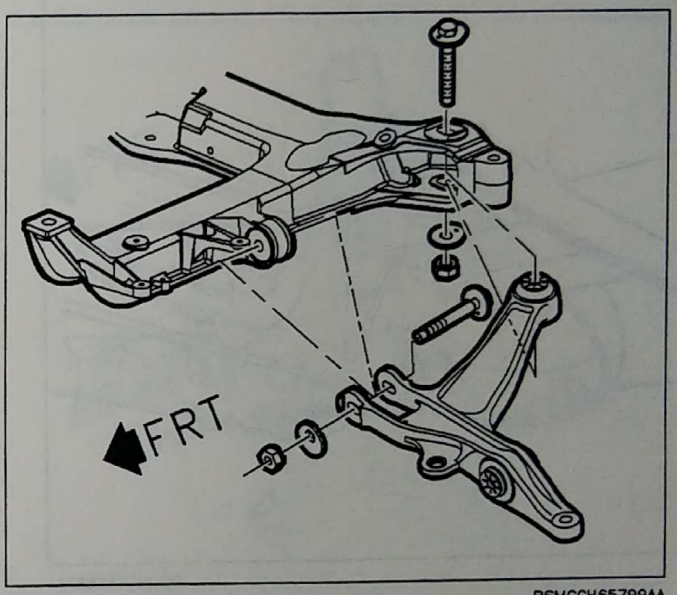
2. Install both front and rear lower control arm to cradle cam bolt assemblies. Tighten nuts on both front and rear lower control arm cam bolt assemblies.

IMPORTANT: Cams must be oriented with chamfered edge towards control arm.

IMPORTANT: Align index marks of cam adjusters before tightening nuts. This will aid in alignment procedures later.

Torque: 150 N•m (111 ft−lbs)

3. Install two cradle to body locator pins, EV9710S (or equivalent) in both right and left rear locations.
4. Using a drive motor support dolly, carefully position cradle into vehicle.



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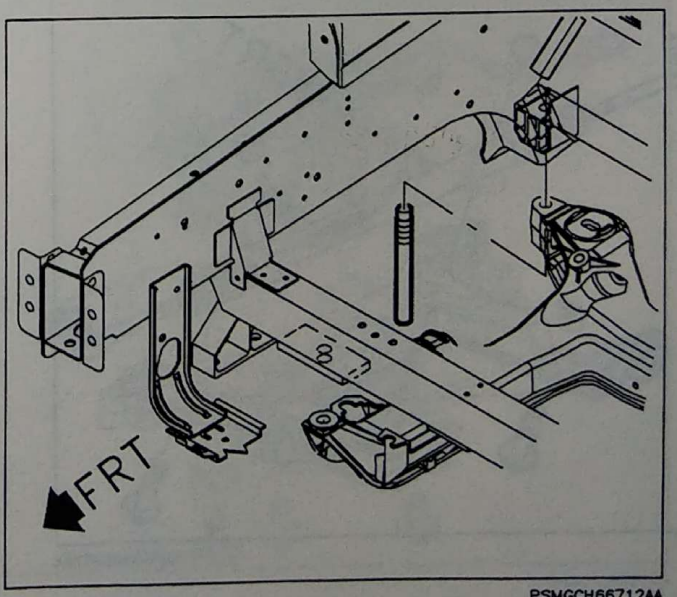
IMPORTANT: The right rear cradle mounting hole is slotted to allow for adjustment of cradle to body alignment.

5. Install two front cradle-to-body bolts, hand tighten.
6. Remove locator pin EV9710S (or equivalent) from left rear and install bolt.

Torque: 180 N•m (133 ft−lbs)

7. Remove locator pin from right rear and install bolt.

Torque: 180 N•m (133 ft−lbs)



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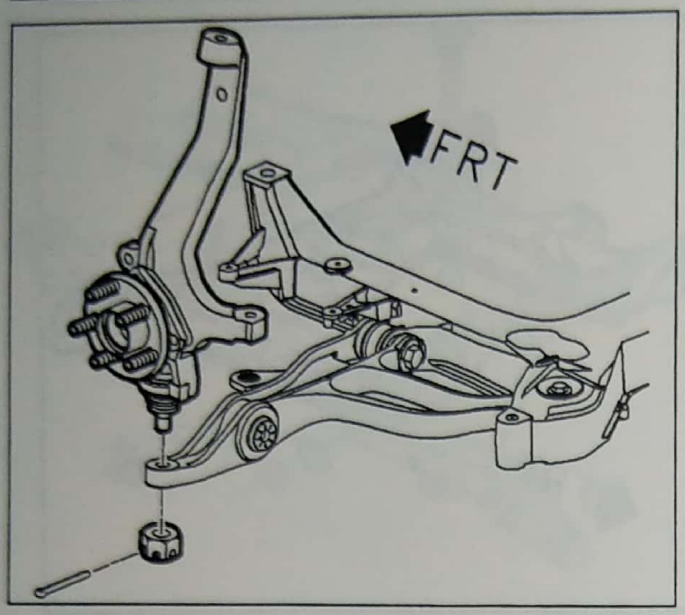

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8. Torque both right and left front cradle to body bolts.

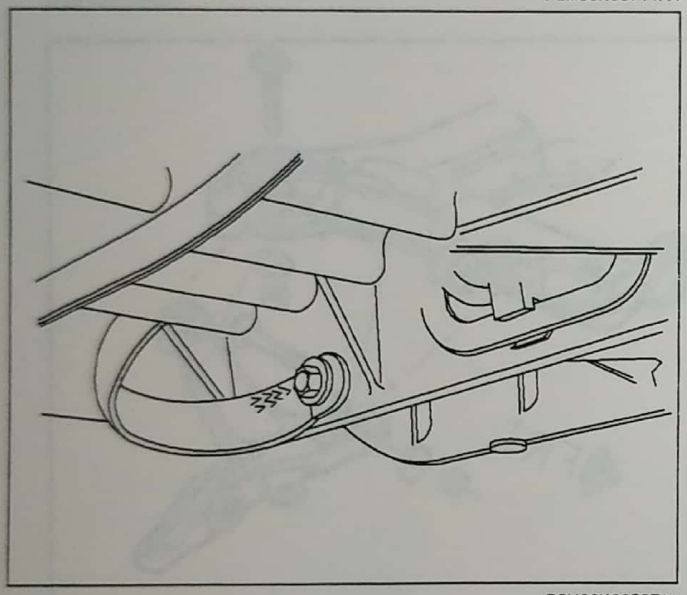
Torque: 180 N•m (133 ft–lbs)

9. Install the steering knuckle lower ball joint stud through the opening in the lower control arm and install castle nut.

IMPORTANT: Ball joint stud threads must be thoroughly cleaned.

10. Tighten lower ball joint stud castle nut and install new cotter pin.

Torque: 10 N•m (88 in–lbs) + 120 degrees



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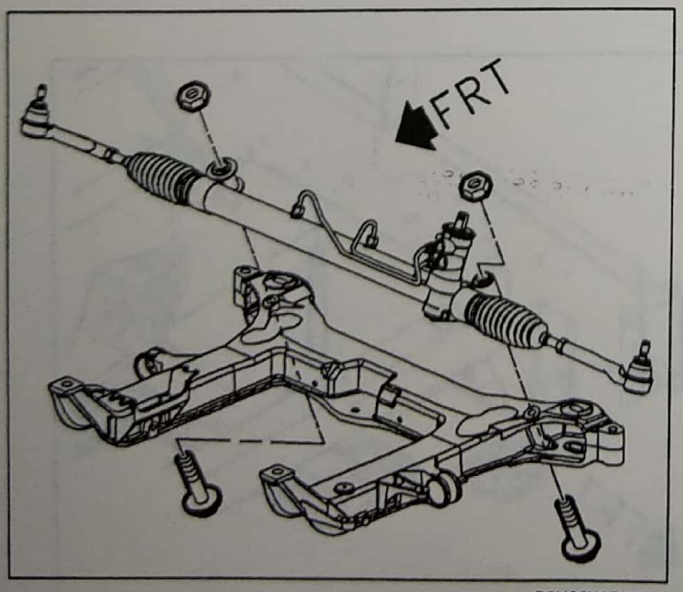
11. Install drive motor ground strap to cradle.

Torque: 30 N•m (22 ft–lbs)



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12. Install steering gear to cradle. Tighten bolts.

Torque: 60 N•m (44 ft–lbs)

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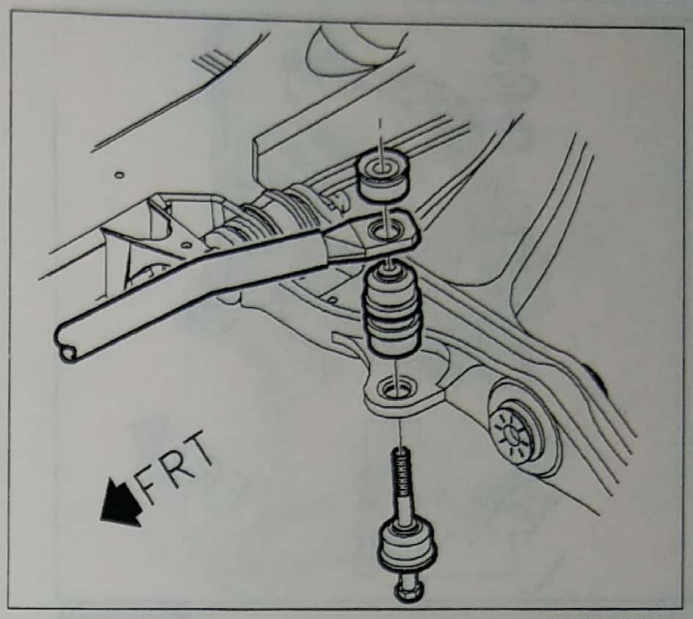
13. Install front stabilizer shaft links to lower control arms, both sides, using EV9716S Stabilizer Link Socket (or equivalent).

Torque: 10 N•m (89 in–lbs)

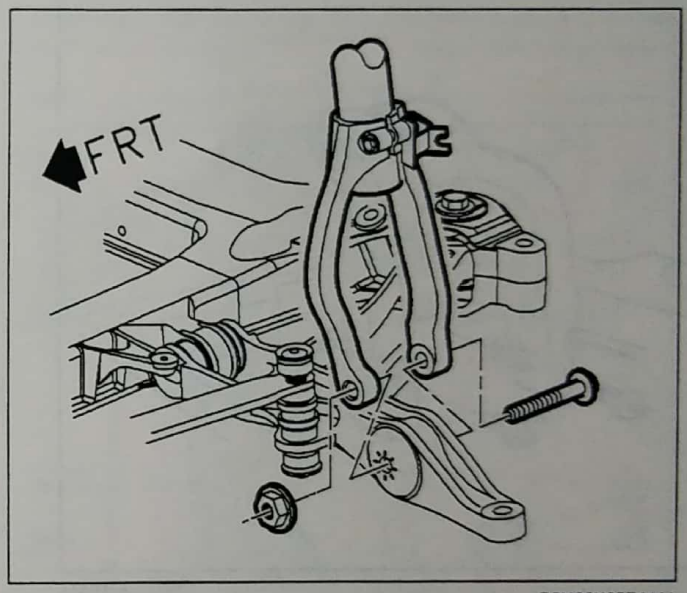


PSMGCH65788AA

14. Install front yokes to lower control arms, both sides. Tighten nuts.

Torque: 150 N•m (111 ft–lbs)

IMPORTANT: Install front yoke to lower control arm's with head of bolt facing towards rear of vehicle.



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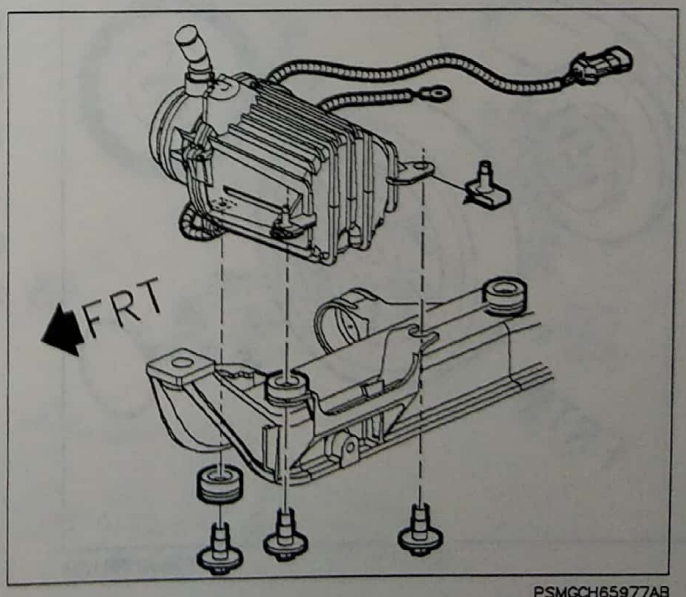
15. Remove power steering pump/motor support strap and install power steering pump/motor to cradle

Torque: 6.0 N•m (53 in–lbs)

16. Connect power steering pump/motor ground wire to cradle.

Torque: 10 N•m (88.5 in–lbs)

17. Connect power steering pump/motor ground sensing harness connector.



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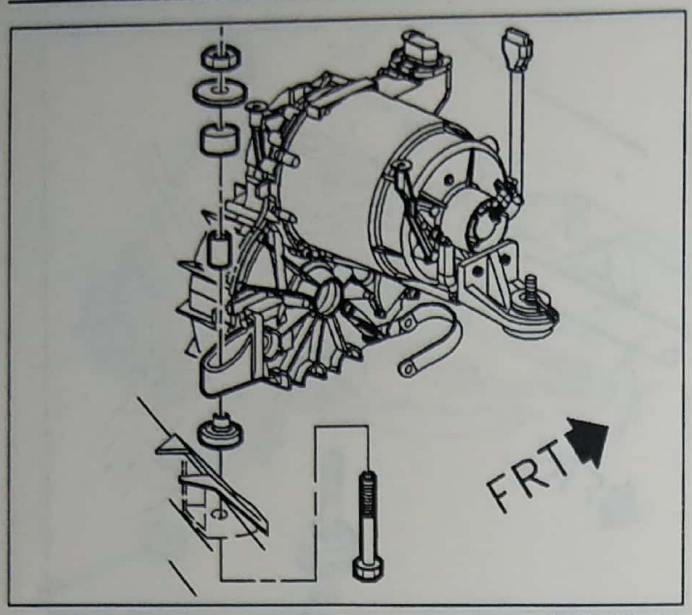

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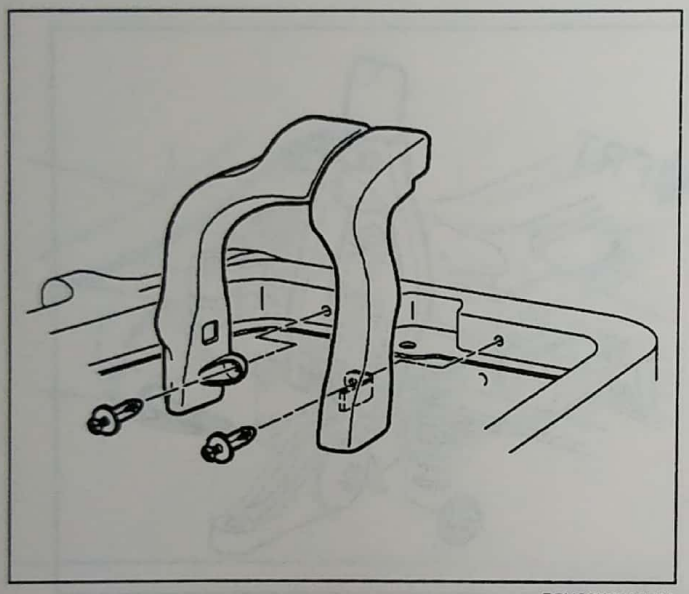
18. Install rear drive motor mount bolt.

Torque: 110 N•m (81 ft–lbs)

19. Install cooling lines and assembly clips to cradle.



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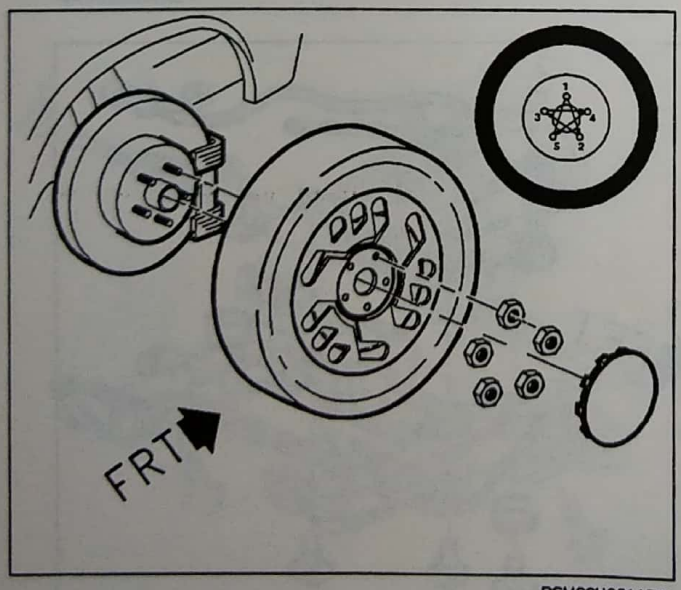
20. Install air outlet duct to cradle.



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NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

21. Install front wheel lug nuts. Tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft–lbs)

22. Lower vehicle.

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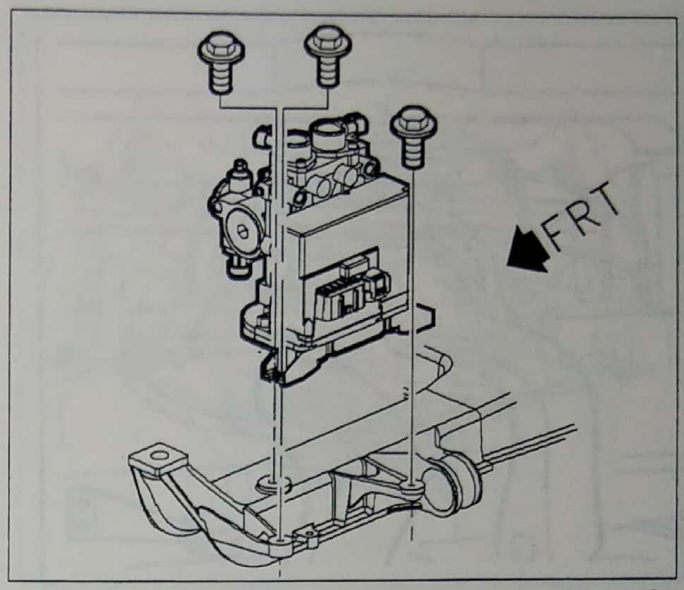
23. Remove brake pressure modulator support strap and install brake pressure modulator assembly.

Torque: 13 N•m (115 in–lbs)



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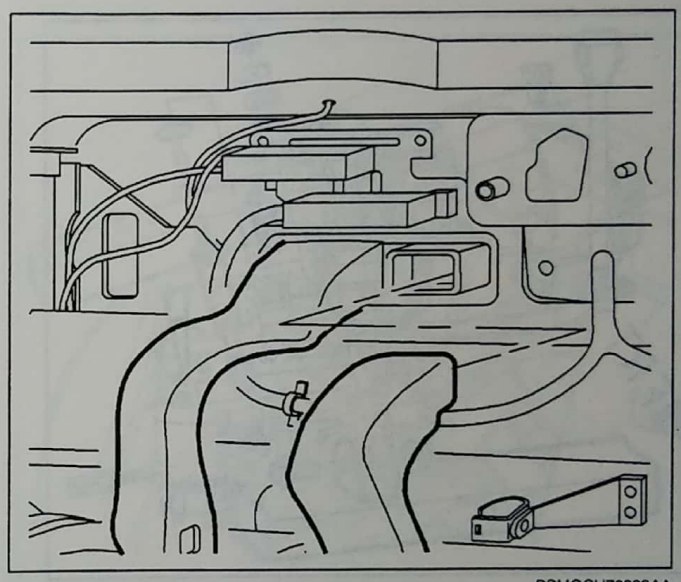
24. Remove drive motor support bar and support plate.
25. Install left air outlet duct.
26. Raise vehicle.



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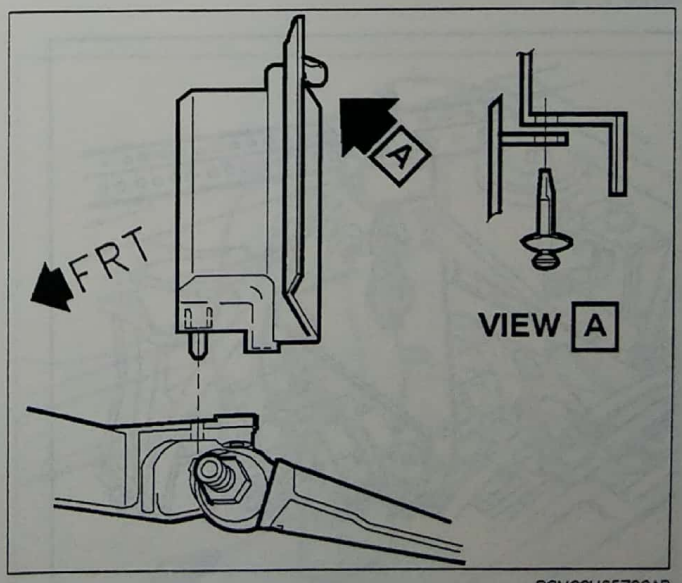
27. Install brake pressure modulator splash shield.
28. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)

Torque: 6 N•m (53 in–lbs)

29. Install the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Installation" procedure in this manual.)
30. Perform vehicle alignment. (Refer to "Alignment" in the "Alignment, Wheels and Tires" section of this manual.)



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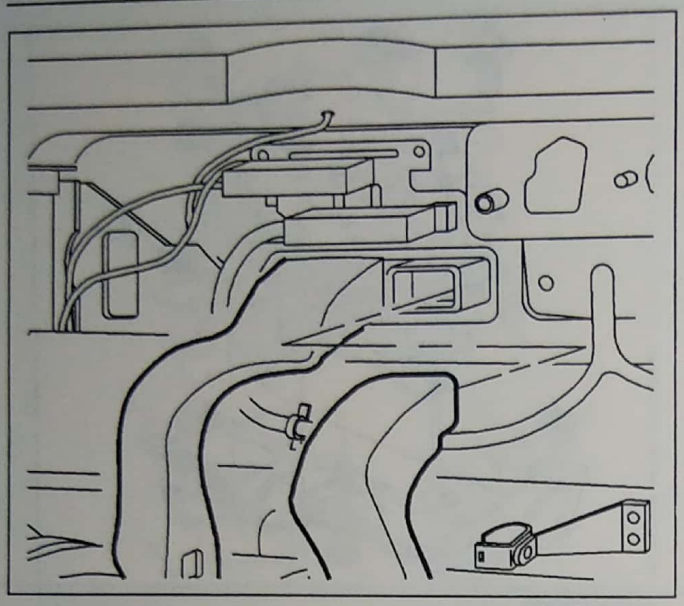

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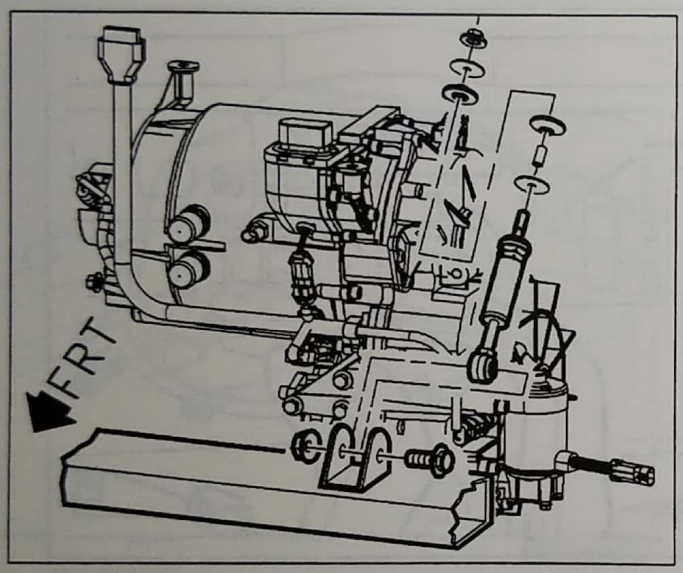

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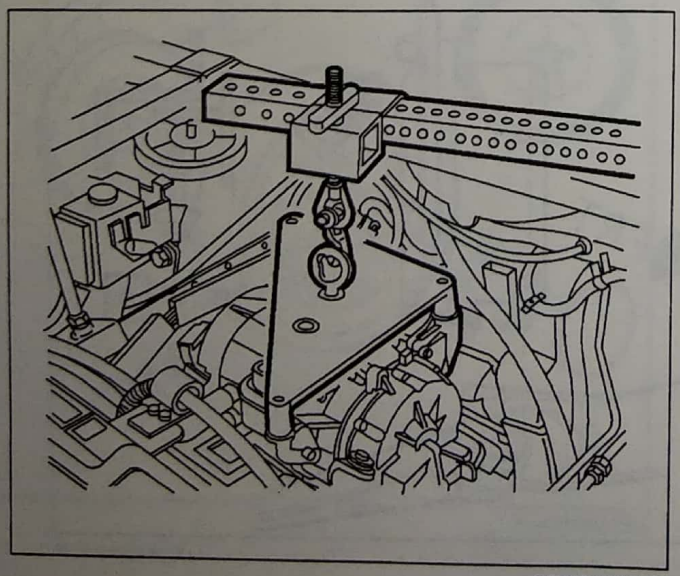

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DRIVE MOTOR MOUNTS

REAR MOTOR MOUNT/BRACKET

REMOVAL

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Remove the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Removal" procedure in this manual.)
2. Remove left air outlet duct.
3. Remove front drive motor shock absorber.

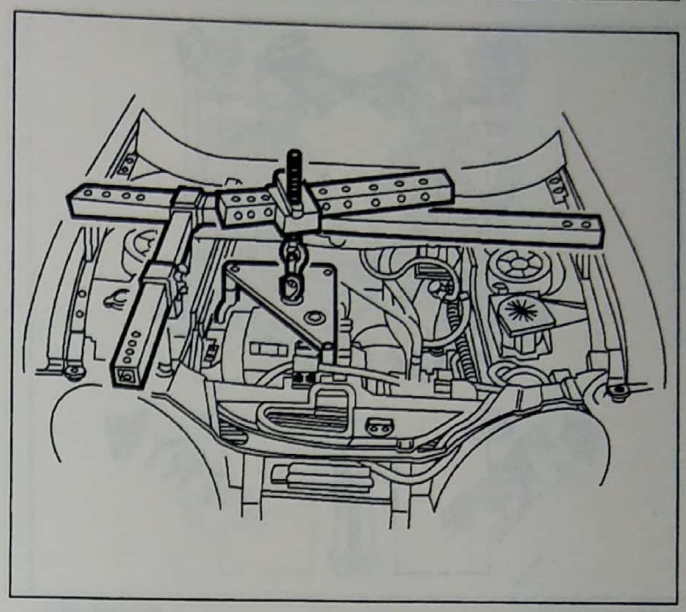
IMPORTANT: Secure top portion of shock using a 24 mm wrench when loosening shock nut. This will prevent shock from rotating.

4. Install drive motor support plate EV9711E (or equivalent).

5. Install drive motor support bar assembly SA9105E (or equivalent).
   a. Assemble support bar using EV9708E adaptor kit (or equivalent).

IMPORTANT: The cross bar on the drive motor support bar fixture have more than one setting. Make sure the attachment pin and hooks are installed in the proper location to prevent damage.

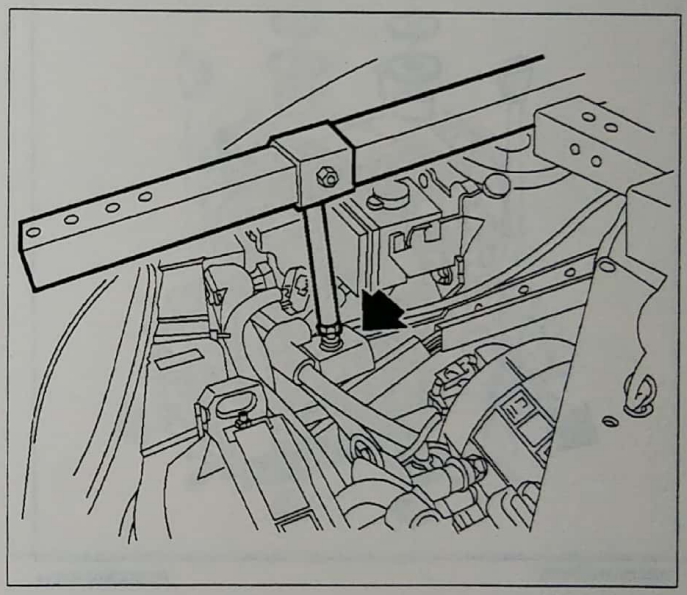
   b. Place drive motor support bar in vehicle as shown. Place the support bar feet on the outer edge of the shock tower.
   c. Connect bar hook to drive motor support plate.



PSMGCH66572AA

   d. Position stabilizer foot per illustration.
   e. Adjust hook and stabilizer to remove looseness.

6. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)



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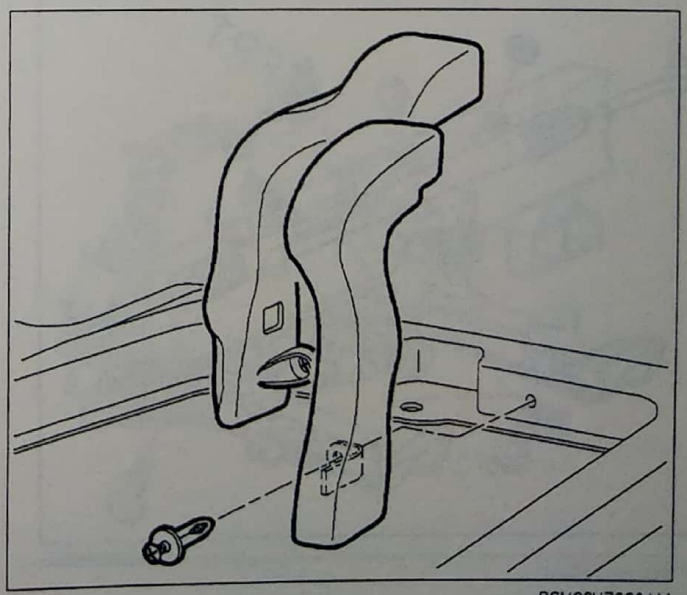
7. Remove push pins from left air outlet duct and push upwards to allow access to rear motor mount nut.



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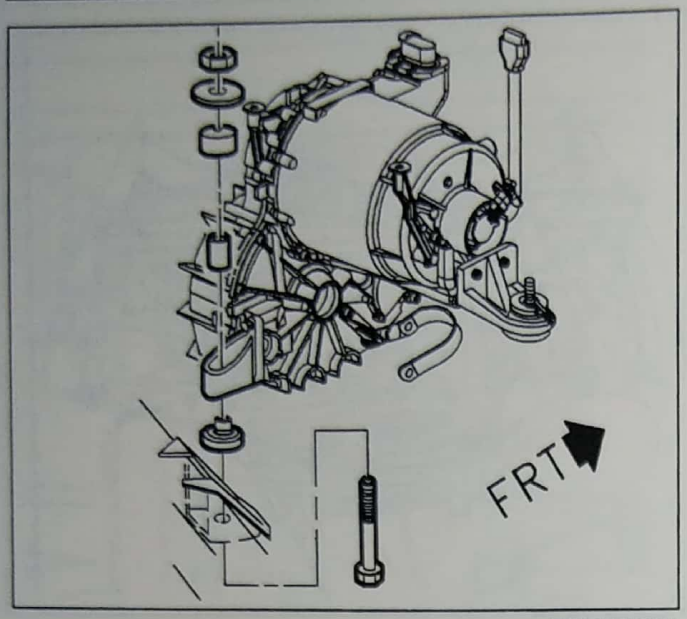

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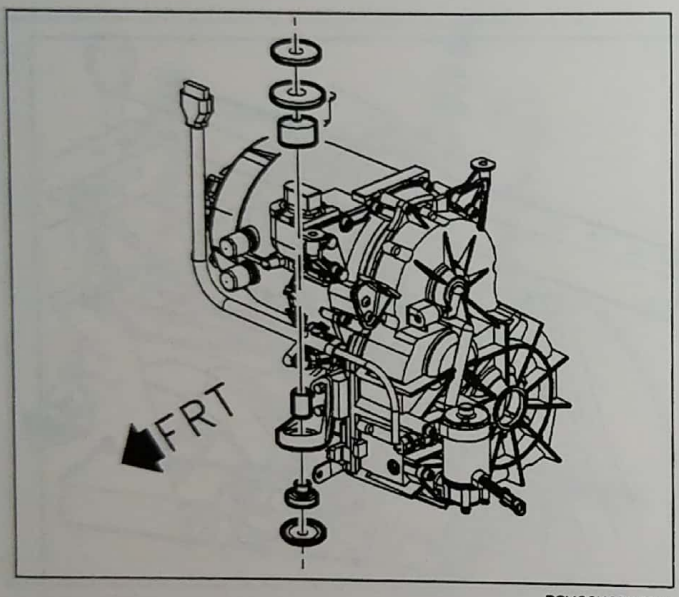
8. Remove rear motor mount through bolt.
9. Remove right hand motor mount bolt.



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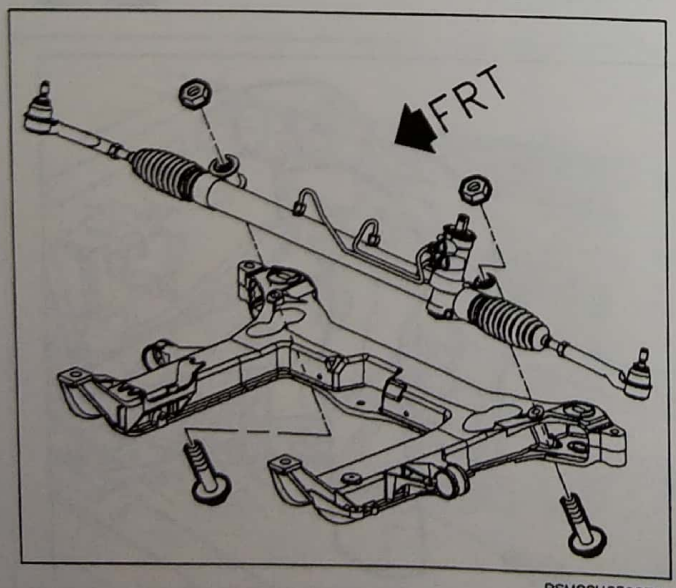
10. Remove front motor mount bolt.



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11. Disconnect steering gear from cradle and push unit rearward.
12. Remove lower right hand bolt from front motor mount.
13. Lower vehicle.
14. Remove harness from the two clips on the front rail to gain access to the front mount bolts.
15. Remove front motor mount bracket from drive unit.
16. Guide supported drive motor assembly towards the front of vehicle.
17. Remove rear motor mount bracket from drive unit.

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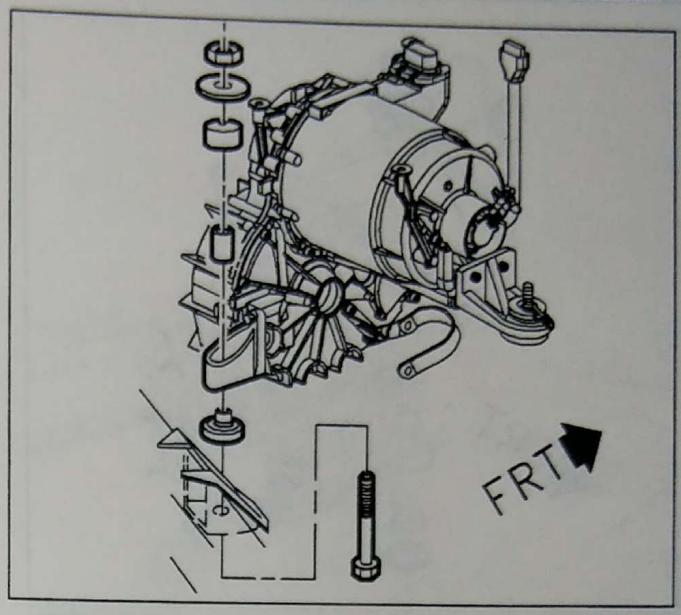
18. Remove rear motor mount.



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INSTALLATION

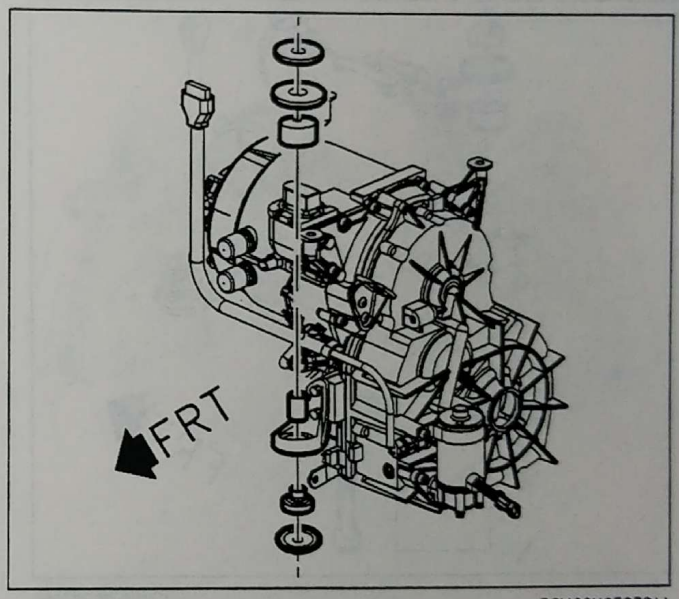
1. Install rear drive motor lower mount and washer onto top of cradle.
2. Attach rear motor mount bracket to drive unit.

Torque: 56 N•m (41 ft−lbs)

3. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
4. Attach front motor mount bracket to drive unit using lower right hand bolt.
5. Lower vehicle.
6. Install remaining front motor mount bracket bolts.

Torque: 100 N•m (74 ft−lbs)

7. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)



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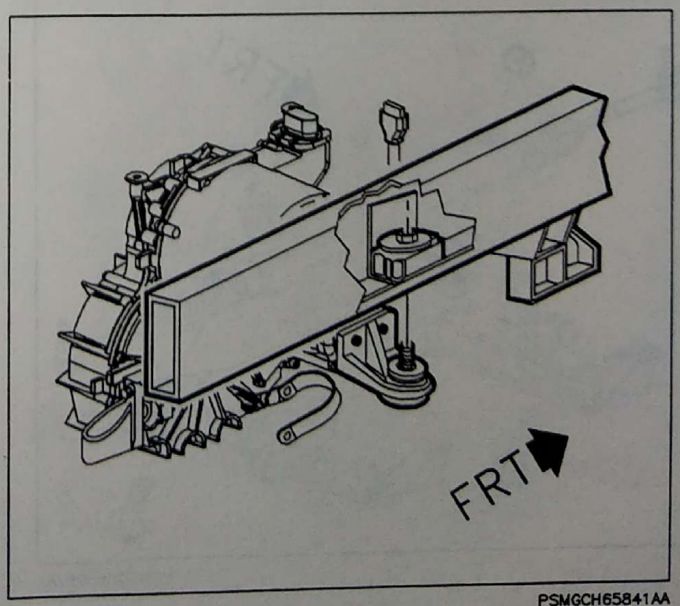
8. Install right hand motor mount bolt with lower washer and lower motor mount and insert bolt through motor mount bracket. Assemble spacer upper motor mount, washer, retainer and secure to body.

Torque: 65 N•m (48 ft−lbs)



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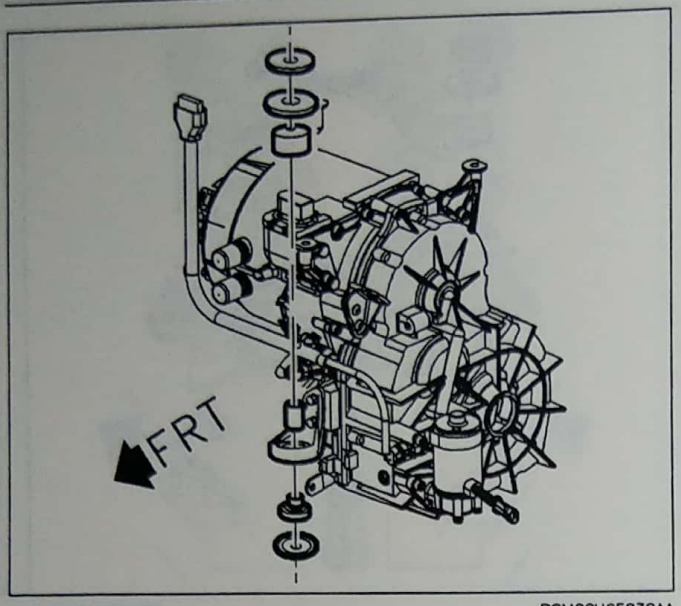

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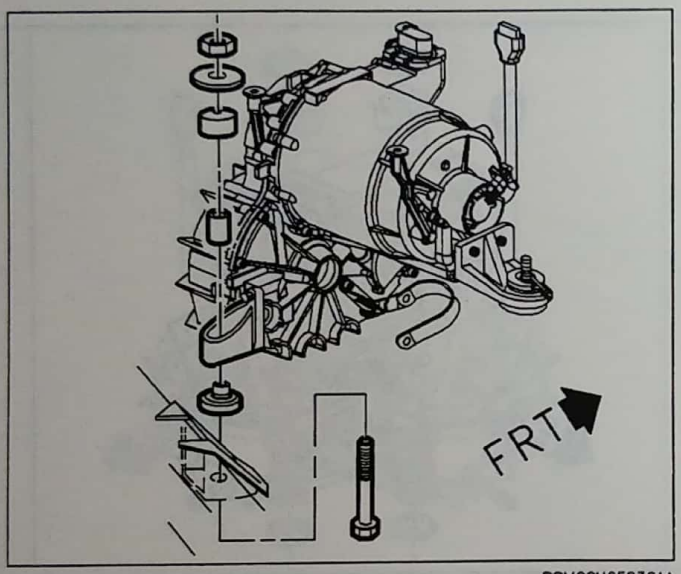
IMPORTANT: Apply Loctite® 242 Threadlocker to threads of front motor mount bolt, prior to installation.

9. Assemble front motor mount bolt with lower washer and lower motor mount and insert bolt through motor mount bracket. Assemble spacer, upper motor mount, washer, retainer and secure to body.

Torque: 92 N•m (68 ft−lbs)



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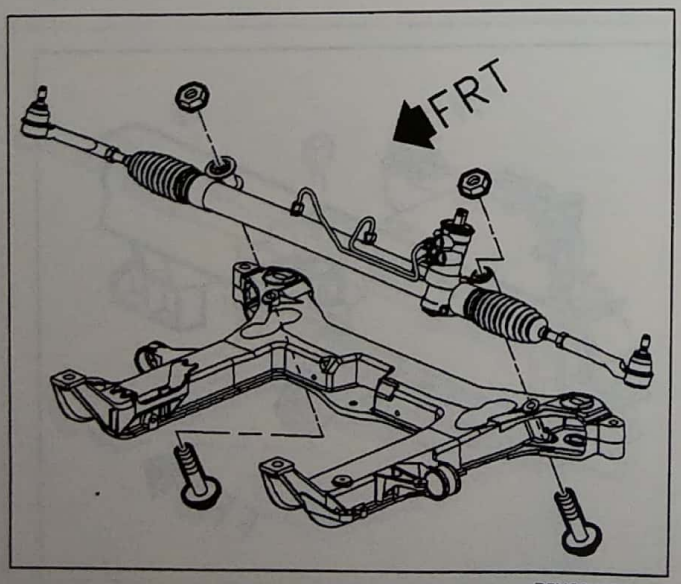
10. Align hole in bracket and install rear drive motor upper mount and washer to the top of the mount bracket. Insert rear drive motor through bolt. Secure with nut.

Torque: 110 N•m (81 ft−lbs)



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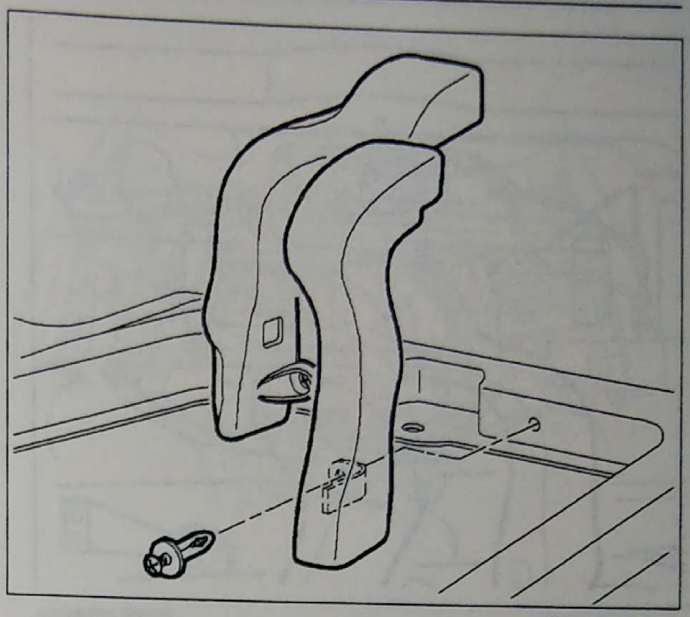
11. Install steering gear to cradle. Tighten bolts.

Torque: 60 N•m (44 ft−lbs)

12. Install lower portion of air outlet duct to cradle.
13. Lower vehicle.



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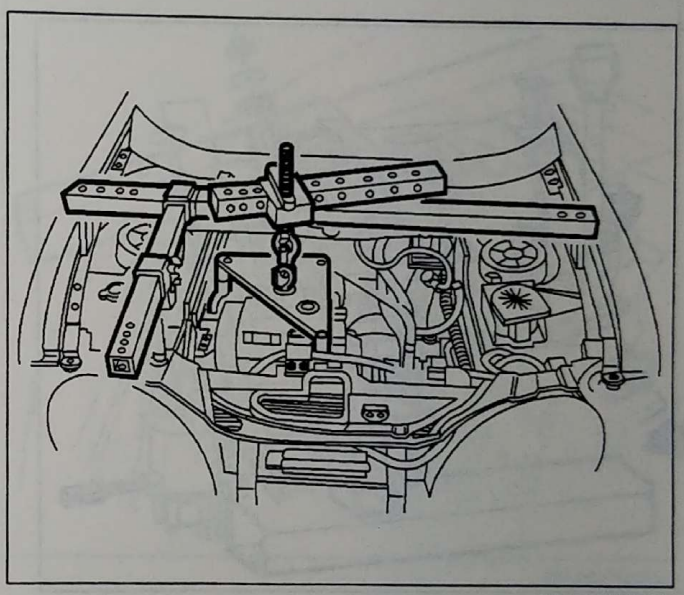
14. Remove drive unit support bar and support plate.

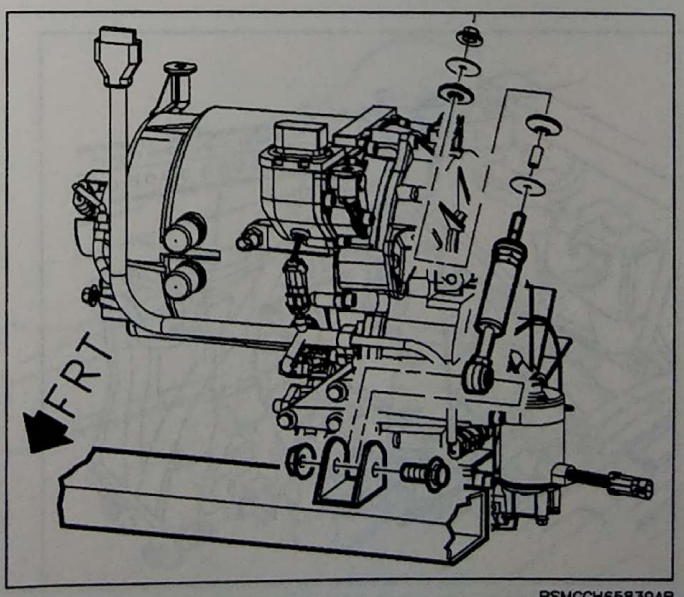


PSMGCH66572AA

15. Install front motor shock absorber.

IMPORTANT: Secure top portion of shock using a 24 mm wrench when tightening shock nut. This will prevent shock from rotating.

Torque: **Top Nut:** **7 N•m (62 in−lbs)**
Bottom Nut: **30 N•m (22 ft−lbs)**



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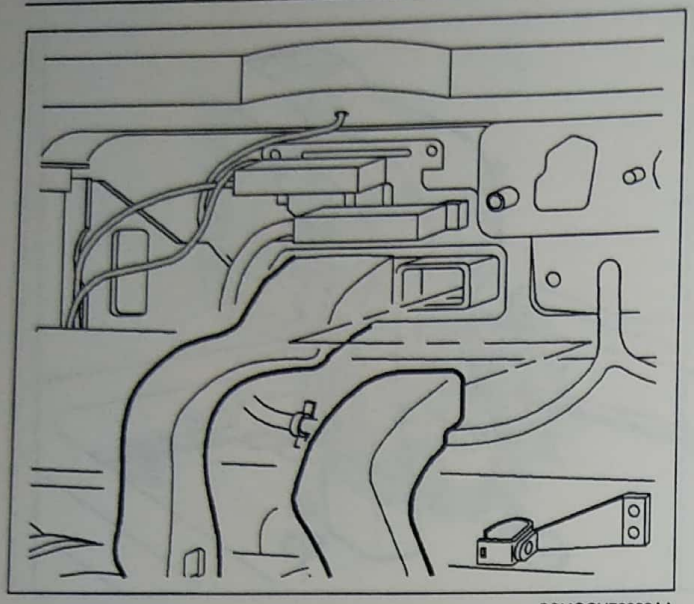

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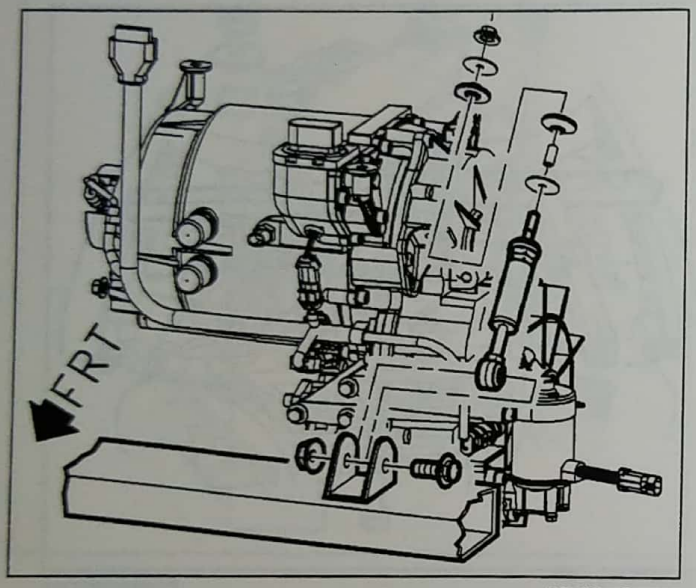
16. Install upper portion of air outlet duct.
17. Install the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Installation" procedure in this manual.)



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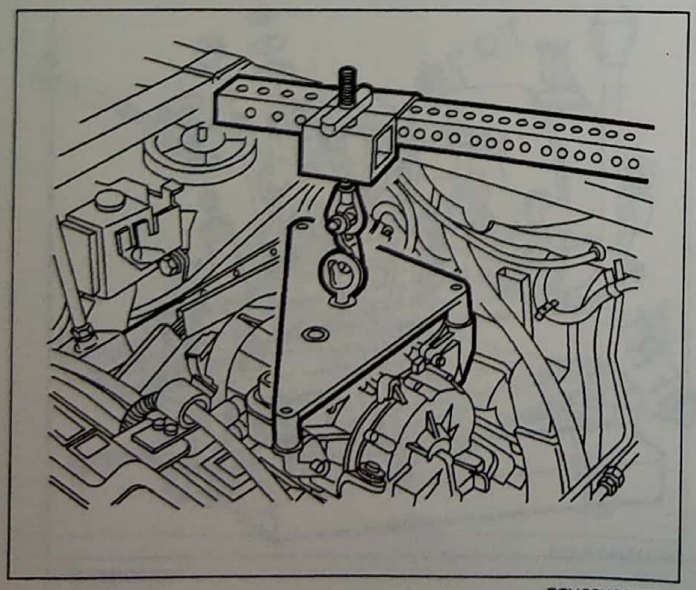
RIGHT HAND MOTOR MOUNT/BRACKET

REMOVAL

1. Remove the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Removal" procedure in this manual.)
2. Remove front drive motor shock absorber.

IMPORTANT: Secure top portion of shock using a 24 mm wrench when loosening shock nut. This will prevent shock from rotating.



PSMGCH66573AA

3. Install drive motor support plate EV9711E (or equivalent).
4. Install drive motor support bar assembly SA9105E (or equivalent).
   a. Assemble support bar using EV9708E adaptor kit (or equivalent).

IMPORTANT: The cross bar on the drive motor support bar fixture have more than one setting. Make sure the attachment pin and hooks are installed in the proper location to prevent damage.

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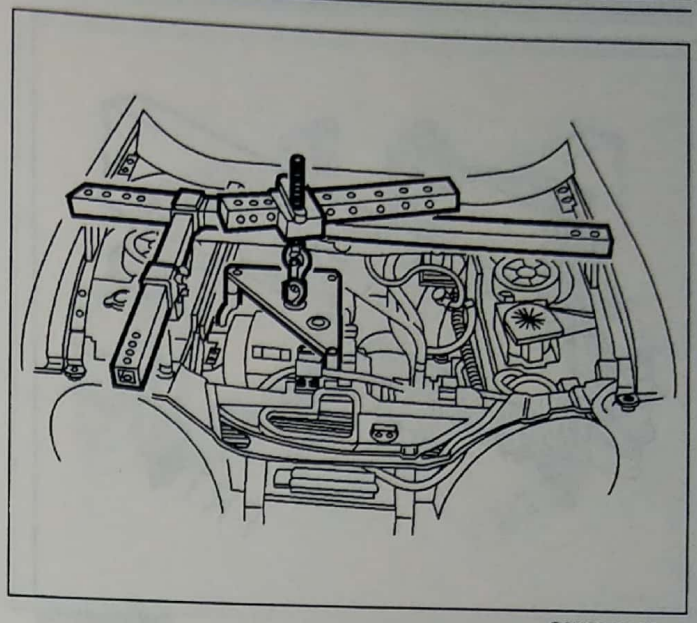
b. Place drive motor support bar in vehicle as shown. Place the support bar feet on the outer edge of the shock tower.

c. Connect bar hook to drive motor support plate.



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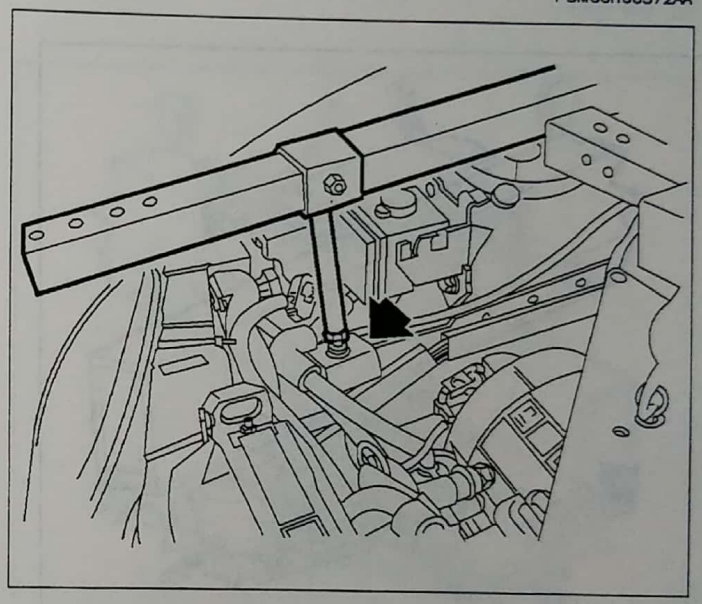
d. Position stabilizer foot per illustration.

e. Adjust hook and stabilizer to remove looseness.

5. Remove top portion of left air outlet duct.

6. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)



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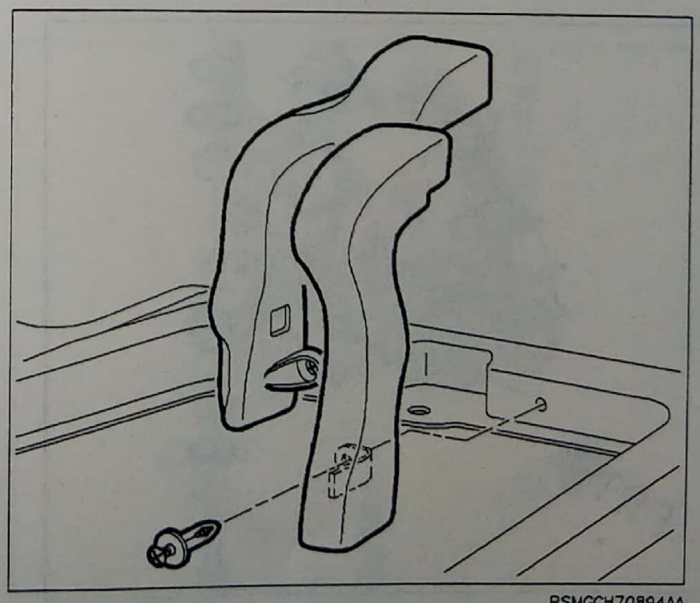
7. Remove push pins from left air outlet duct and push upwards to allow access to rear motor mount nut.



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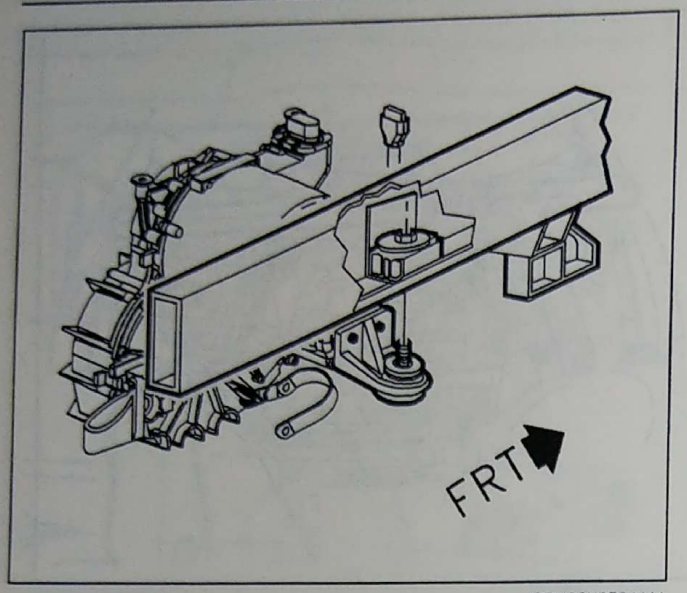

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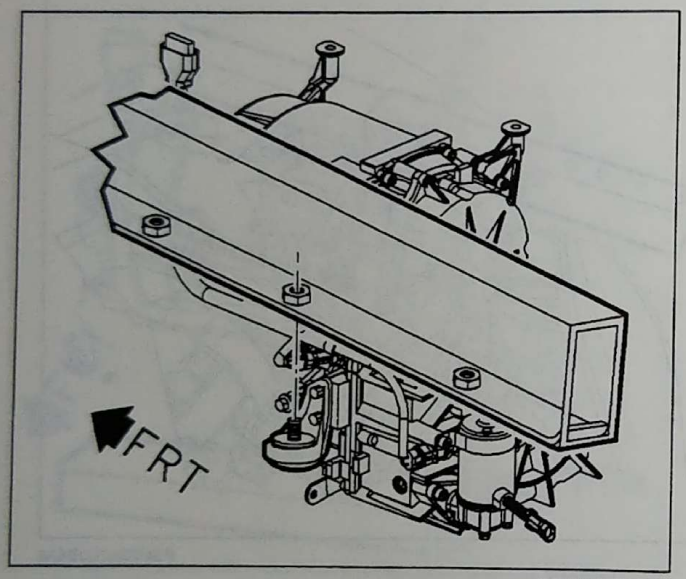
8. Remove right hand motor mount bolt.
9. Remove rear motor mount through bolt.



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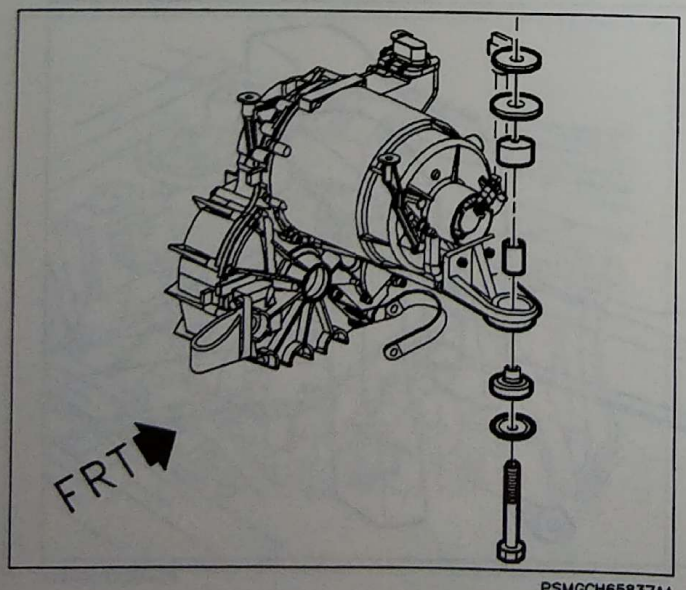
10. Remove front motor mount bolt.
11. Lower vehicle.
12. Remove right side drive motor mount bracket.
13. Remove top portion of mount.



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INSTALLATION

1. Attach right side motor mount bracket to drive motor.

Torque: 100 N•m (74 ft−lbs)

2. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
3. Assemble top portion of right hand motor mount and install between motor mount bracket and mid rail.

IMPORTANT: Carefully pull down on right side of drive motor enough to install top portion of mount.

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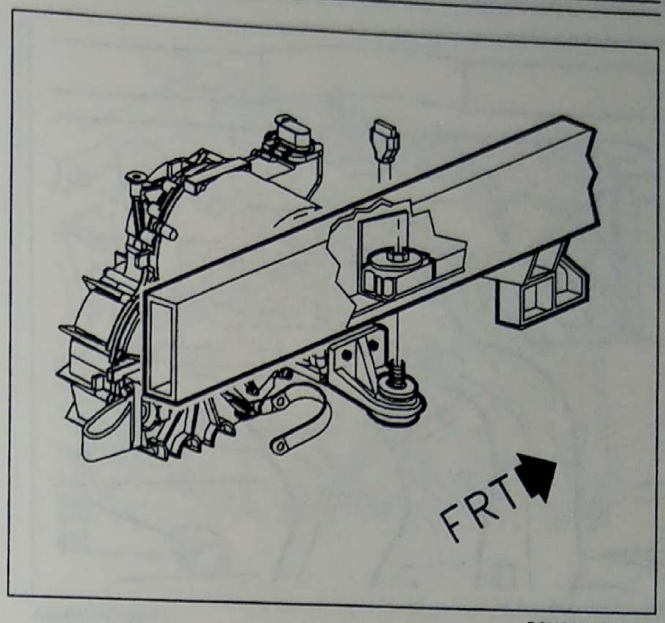
4. Assemble lower washer and motor mount on the bolt and insert bolt through motor mount bracket, upper mount and into mid rail.
5. Tighten right hand motor mount bolt.

Torque: 65 N•m (48 ft−lbs)



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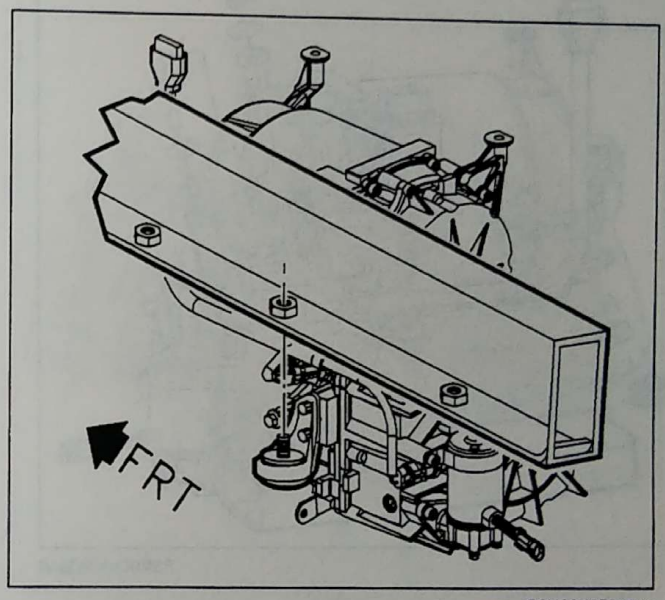
IMPORTANT: Apply Loctite® 242 Threadlocker to threads of front motor mount bolt, prior to installation.

6. Install and tighten front motor mount bolt.

Torque: 92 N•m (68 ft−lbs)



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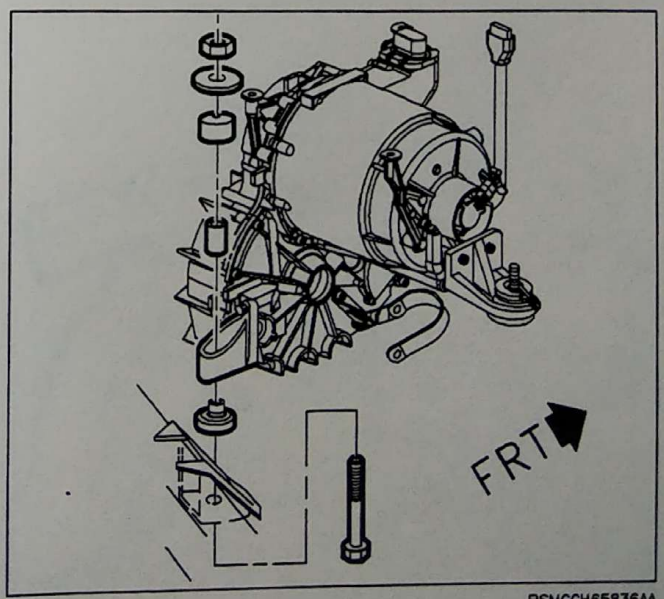
7. Install and tighten rear motor mount through bolt.

Torque: 110 N•m (81 ft−lbs)

8. Install lower portion of left air outlet duct to cradle.
9. Lower vehicle.
10. Remove drive motor support bar and support plate.



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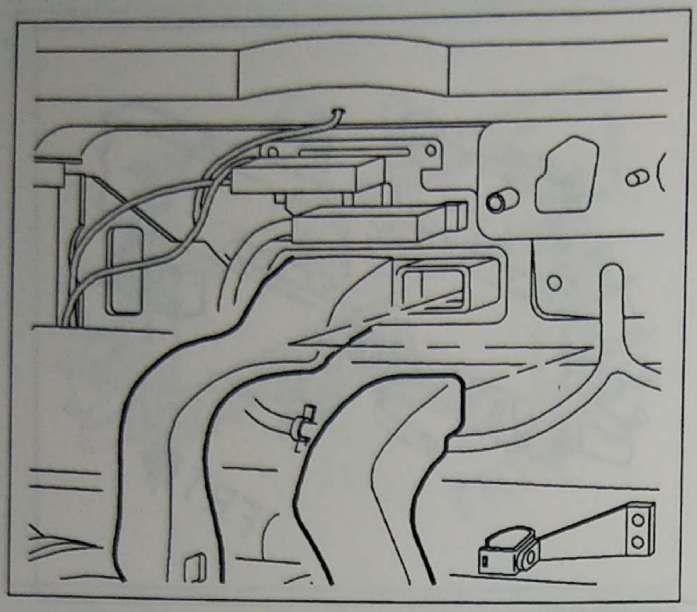

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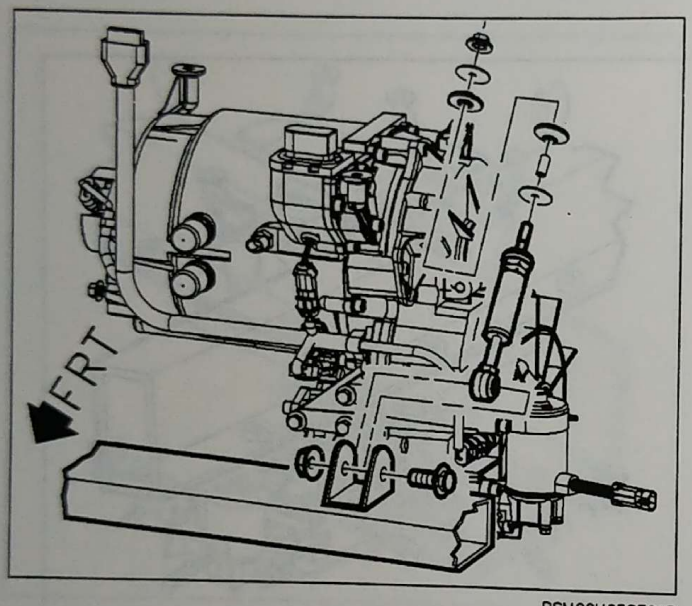

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11. Install top portion of left air outlet duct.

12. Install front motor shock absorber.

IMPORTANT: Secure top portion of shock using a 24 mm wrench when tightening shock nut. This will prevent shock from rotating.

Torque: **Top Nut:** **7 N•m (62 in−lbs)**
Bottom Nut: **30 N•m (22 ft−lbs)**

13. Install the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Installation" procedure in this manual.)

FRONT MOTOR MOUNT/BRACKET

REMOVAL

1. Remove the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Removal" procedure in this manual.)
2. Remove front drive motor shock absorber.

IMPORTANT: Secure top portion of shock using a 24 mm wrench when loosening shock nut. This will prevent shock from rotating.

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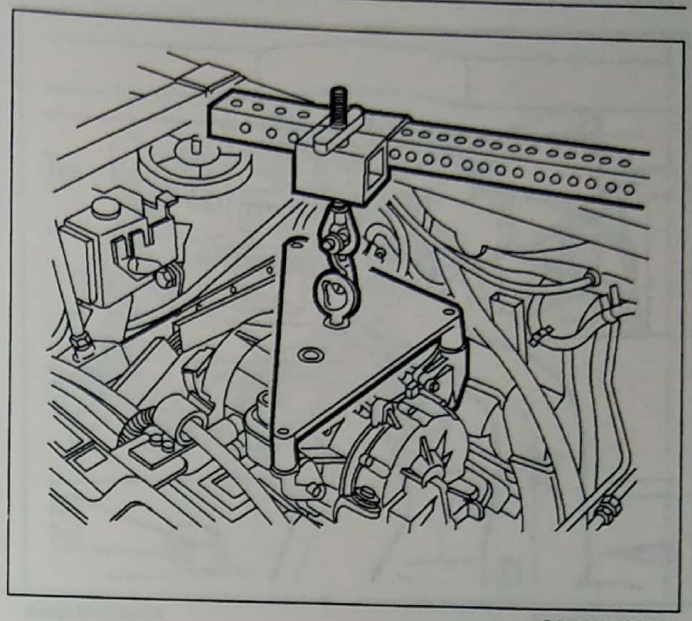
3. Install drive motor support plate EV9711E (or equivalent).
4. Install drive motor support bar assembly SA9105E (or equivalent).
   a. Assemble support bar using EV9708E adapter kit (or equivalent).

IMPORTANT: The cross bars on the drive motor support bar fixture have more than one setting. Make sure the attachment pin and hooks are installed in the proper location to prevent damage.



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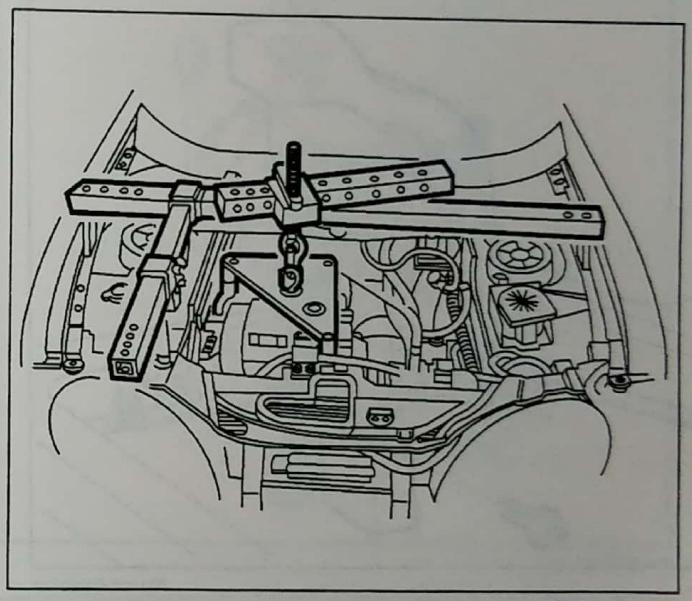
   b. Place drive motor support bar in vehicle as shown. Place the support bar feet on the outer edge of the shock tower.
   c. Connect bar hooks to drive motor support plate.



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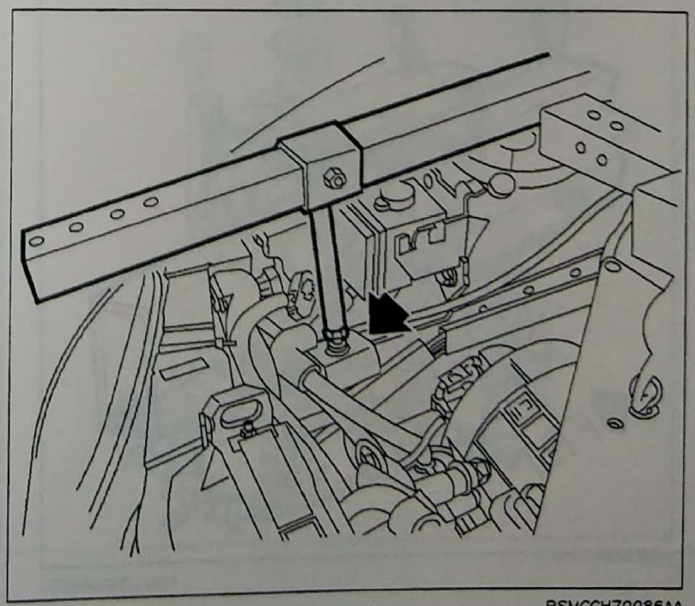
   d. Position stabilizer foot per illustration.
   e. Adjust hook and stabilizer to remove looseness.



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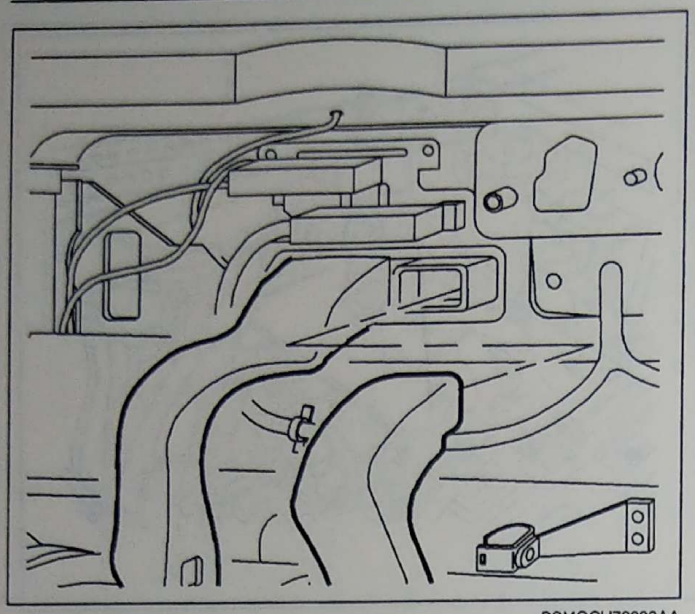
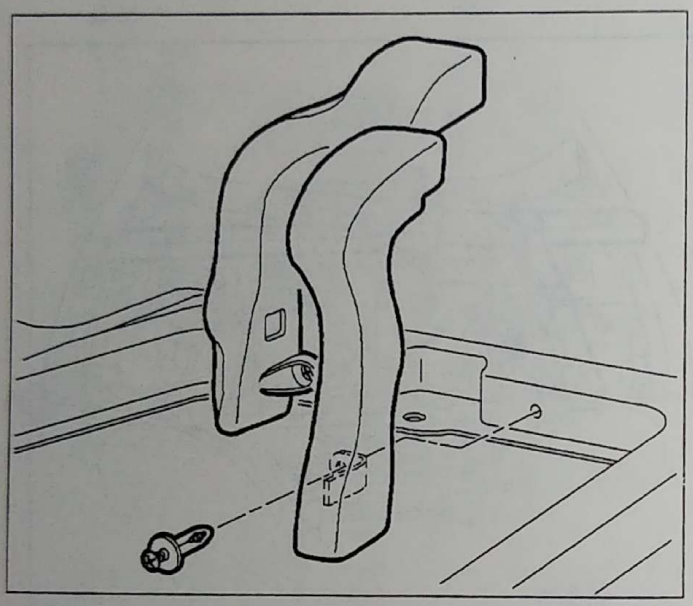


PSMGCH70893AA

5. Disconnect top portion of left air outlet duct.
6. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)



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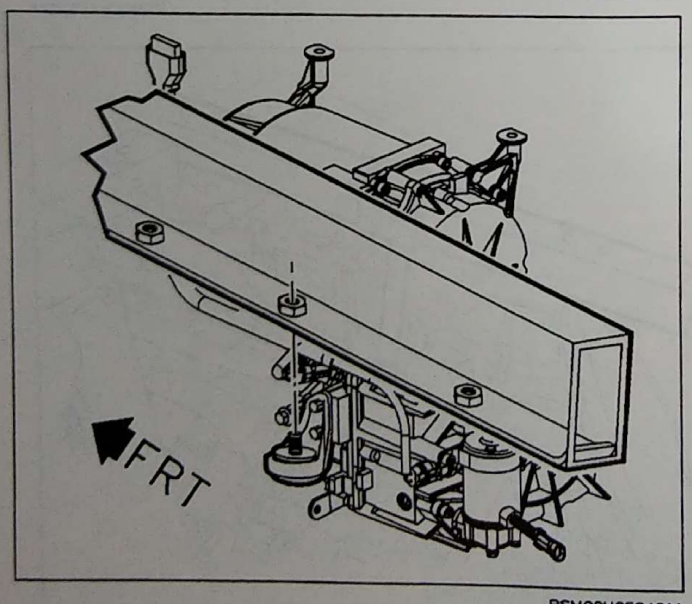
7. Remove push pins from left air outlet duct and push upwards to allow access to rear motor mount nut.



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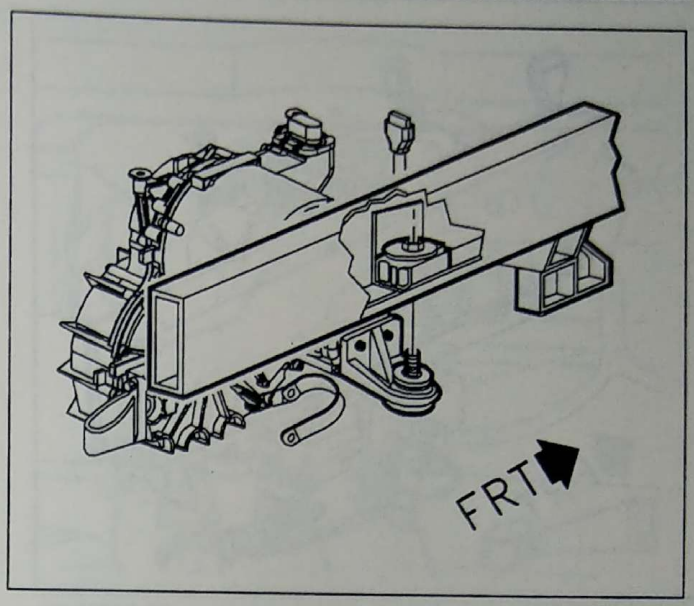
8. Remove rear motor mount through bolt.
9. Remove front motor mount bolt and lower portion of mount.

10. Remove right hand motor mount bolt.
11. Remove lower right hand bolt from front motor mount.



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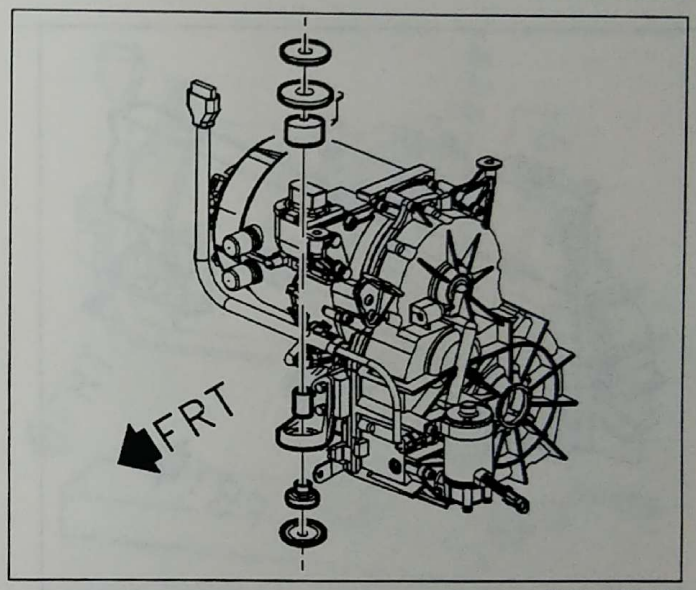
12. Lower vehicle.
13. Remove front drive motor mount bracket.
14. Remove top portion of front motor mount.



PSMGCH65838AA

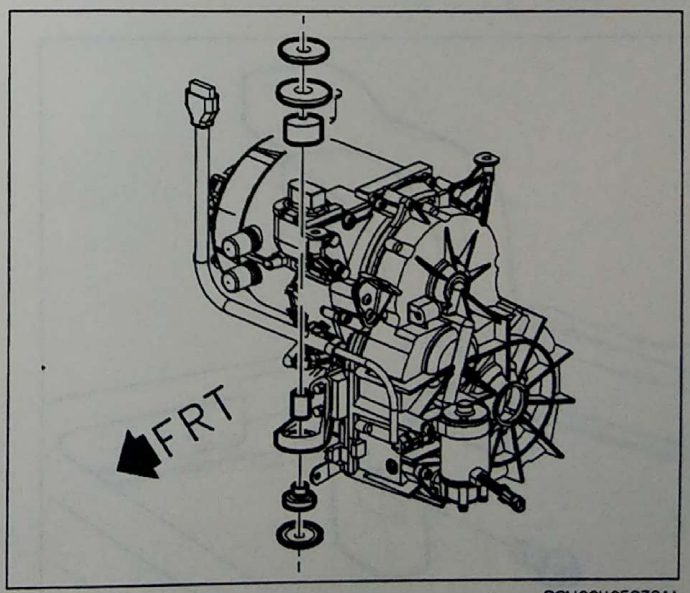
INSTALLATION

1. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Attach front motor mount bracket to drive unit using lower right hand bolt.
3. Lower vehicle.
4. Install remaining front motor mount bracket bolts.

Torque: 100 N•m (74 ft−lbs)

5. Raise vehicle. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
6. Assemble top portion of front drive motor mount and install between motor mount bracket and crossmember.

IMPORTANT: Carefully pull down on front of drive motor enough to install top portion of front motor mount.



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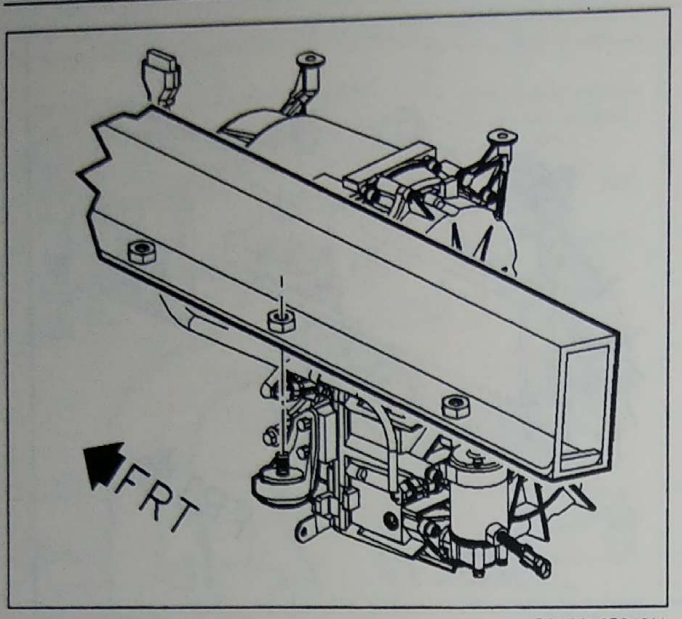

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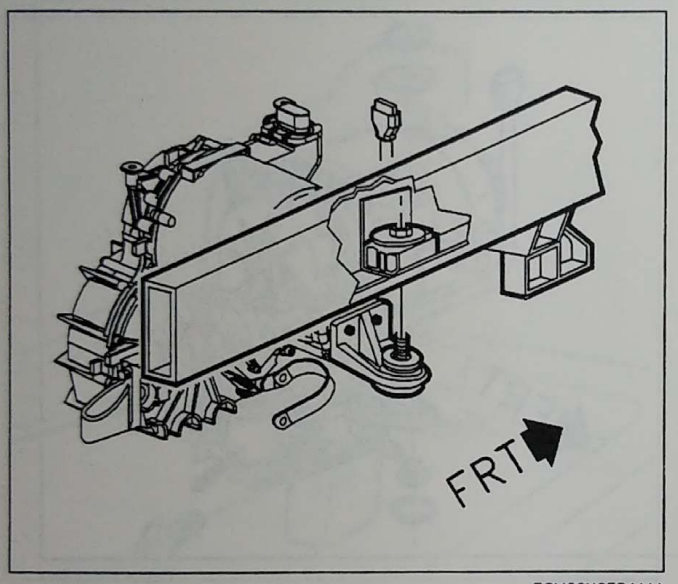
IMPORTANT: Apply Loctite® 242 Threadlocker to threads of front motor mount bolt, prior to installation.

7. Assemble lower washer and motor mount on the bolt and insert bolt through motor mount bracket, upper mount and into crossmember.
8. Install and tighten front motor mount bolt.

Torque: 92 N•m (68 ft−lbs)



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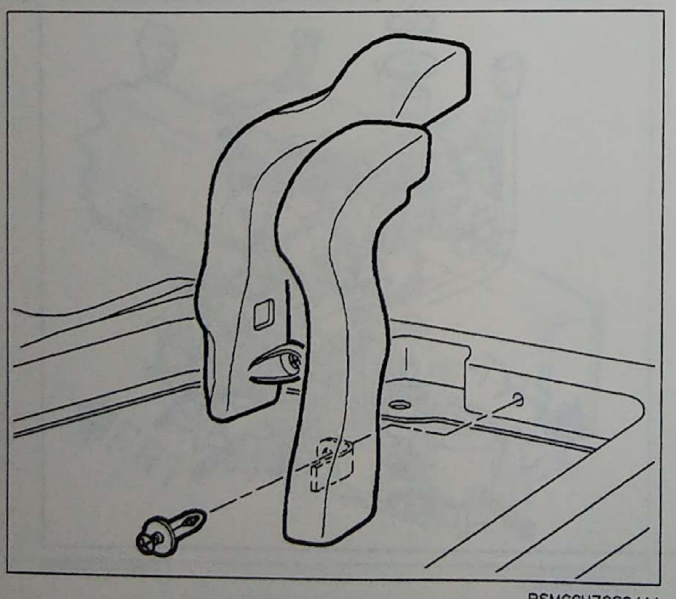
9. Install and tighten right hand motor mount bolt.

Torque: 65 N•m (48 ft−lbs)

10. Install and tighten rear motor mount through bolt.

Torque: 110 N•m (81 ft−lbs)



PSMGCH70894AA

11. Install lower portion of air outlet duct to cradle.
12. Lower vehicle.
13. Remove drive motor support bar and support plate.

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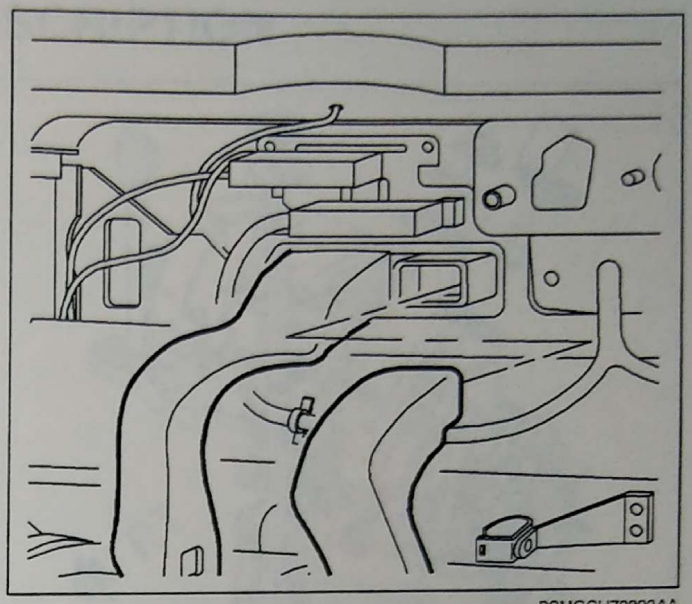
14. Install top portion of air outlet duct.



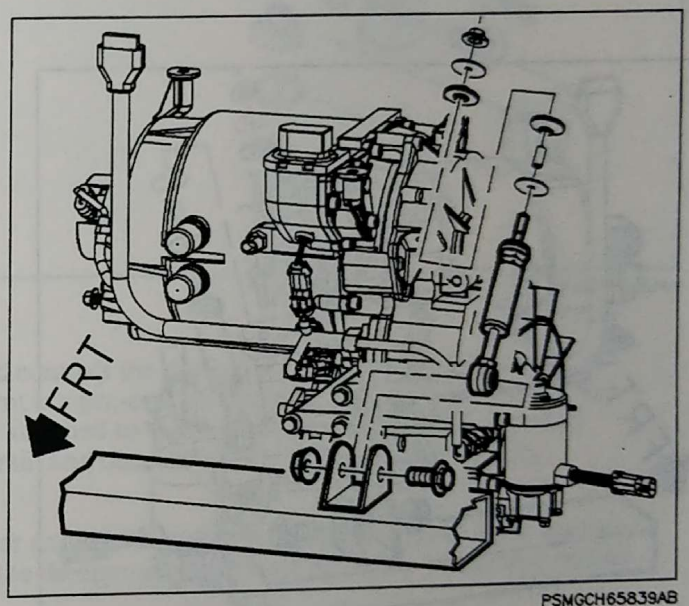
PSMGCH70893AA

15. Install front motor shock absorber.

IMPORTANT: Secure top portion of shock using a 24 mm wrench when tightening shock nut. This will prevent shock from rotating.

Torque: **Top Nut:** **7 N•m (62 in−lbs)**
Bottom Nut: **30 N•m (22 ft−lbs)**

16. Install the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Installation" procedure in this manual.)



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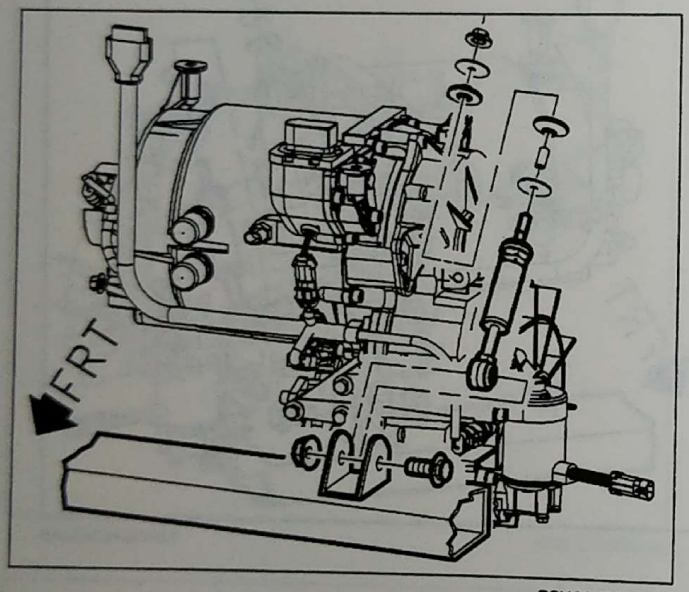
MOTOR SHOCK ABSORBER/UPPER BRACKET

REMOVAL

1. Remove the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Removal" procedure in this manual.)
2. Remove front shock absorber from drive motor bracket by removing top nut, washer and insulator.

IMPORTANT: Secure top portion of shock using a 24 mm wrench when loosening shock nut. This will prevent shock from rotating.

3. Remove front shock absorber to crossmember bolt and remove shock absorber.
4. Remove fasteners securing upper bracket to drive motor and remove bracket.



PSMGCH65839AB

INSTALLATION

1. Install upper bracket to drive motor.

Torque: 22 N•m (16 ft−lbs)

IMPORTANT: For drive motor lower shock absorber bracket, refer to "Body/Collision" service manual.

2. Assemble lower washer and insulator to top portion of shock.
3. Insert top section of shock through drive motor bracket.
4. Install bottom of shock absorber to crossmember bracket and tighten bolt.

Torque: 30 N•m (22 ft−lbs)

5. Install upper insulator, washer and tighten nut.

Torque: 7 N•m (62 in−lbs)

IMPORTANT: Secure top portion of shock using a 24 mm wrench when tightening shock nut. This will prevent shock from rotating.

6. Install the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Installation" procedure in this manual.)

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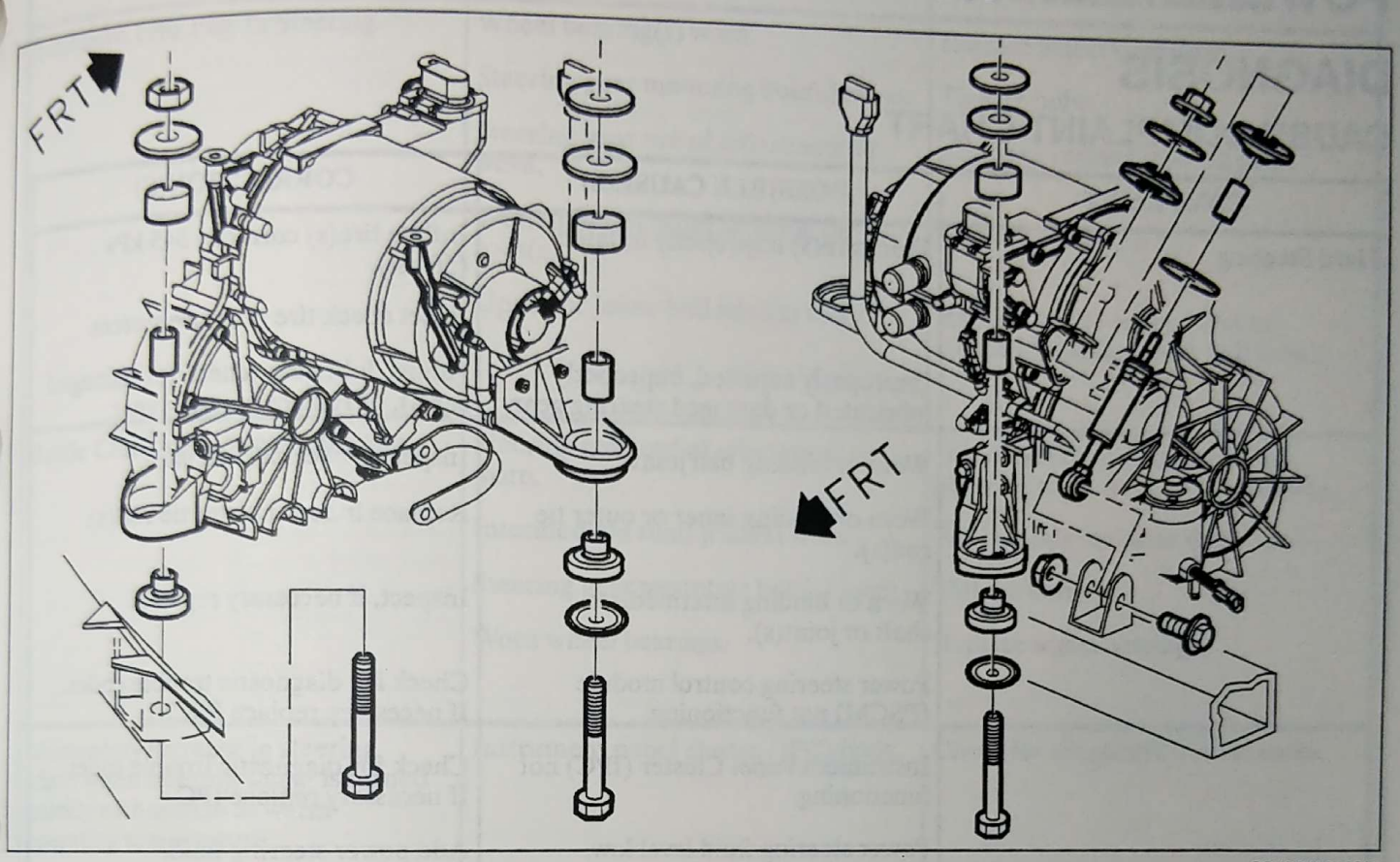
GENERAL DESCRIPTION



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The EV1 propulsion mounting system supports the weight and controls the motion of the powertrain. It consist of three motor mounts and one motion damper. The motor mount is a pre-compressed type that is composed of a two piece (upper and lower halves) rubber elements. There is one attached to the front of the motor and to the body crossmember, one for the right side of the motor to body midrail, and one for the rear of the motor to cradle crossmember.

The motion damper assembly attaches to the front of the motor and to the body crossmember. This damper controls the pitch motion (back and forth) of the motor. Both ends of the damper assembly have pre-compressed type rubber elements to provide vibration isolation.

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POWER STEERING

DIAGNOSIS

CAUSE/COMPLAINT CHART

COMPLAINT	POSSIBLE CAUSE(S)	CORRECTION(S)
Hard Steering	Front tire(s) improperly inflated.	Inflate tire(s) correctly 345 kPa (50 psi). Reset check tire pressure system.
	Improperly adjusted, improperly lubricated or damaged steering gear.	Adjust, lubricate (check for damaged seals), or replace steering gear.
	Worn or binding ball joints.	Inspect if necessary replace.
	Worn or binding inner or outer tie rod(s).	Replace inner or outer tie rod(s).
	Worn or binding intermediate shaft or joint(s).	Inspect, if necessary replace.
	Power steering control module (PSCM) not functioning.	Check for diagnostic trouble codes. If necessary replace PSCM.
	Instrument Panel Cluster (IPC) not functioning.	Check for diagnostic trouble codes. If necessary replace IPC
	Power steering fluid level low.	Add power steering fluid.
	Insufficient power steering pump pressure.	Refer to power steering test procedures.
	Faulty EHPS pump/motor.	Refer to power steering test procedures.
	Restricted or leaking power steering hoses.	Repace hoses or tighten hose connections.
	High internal leakage in steering gear.	Replace steering gear.
	Excessive front wheel caster.	Adjust front wheel caster.
	Binding within steering column or intermediate shaft boot.	Inspect column and boot. If necessary replace.
Poor Return of Steering Wheel to Center.	Front tire(s) improperly inflated.	Inflate tire(s) to the correct pressure 345 kPa (50 psi). Reset check tire pressure system.
	Improperly adjusted, improperly lubricated, or binding steering gear.	Adjust, lubricate (check for damaged seals), or replace steering gear.
	Incorrect front wheel caster.	Adjust front wheel caster.
	Worn or binding inner or outer tie rod end(s).	Replace inner or outer tie rod(s).
	Worn or binding intermediate shaft joint(s).	Replace intermediate shaft.
	Binding within steering column or intermediate shaft boot.	Inspect steering column and intermediate shaft and boot. If necessary replace.

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COMPLAINT	POSSIBLE CAUSE(S)	CORRECTION(S)
Excessive Free Play in Steering.	Wheel bearing(s) worn.	Replace wheel bearing(s).
	Steering gear mounting bolt(s) loose.	Tighten bolts.
	Steering gear out of adjustment or worn.	Adjust or replace steering gear.
	Worn inner or outer steering tie rods(s).	Replace tie rod(s).
	Upper or lower ball joint(s) worn.	Replace upper control arm or steering knuckle (lower ball joint).
Rattle Clunking Noise in Steering.	Steering gear out of adjustment or worn.	Inspect steering gear, inner and outer tie rods. Replace if necessary.
	Intermediate shaft joint(s) worn.	Replace intermediate shaft.
	Steering gear mounting bolt(s) loose.	Tighten bolt(s).
	Worn wheel bearings.	Replace wheel bearings.
Momentary increase in steering effort when steering wheel is turned quickly with system at warm operating temperature.	Instrument panel cluster (IPC) fault.	Check for diagnostic trouble codes.
	High internal leakage in steering gear.	Replace steering gear.
	Low power steering fluid level.	Correct power steering fluid level.
	Insufficient pump pressure.	Refer to power steering test procedures. If necessary replace pump and or motor.
	Damaged handwheel sensor.	Check for codes. Replace handwheel sensor if necessary.
Steering Wheel Surges or Jerks when Turning at Low Speeds.	Insufficient power steering pump pressure.	Refer to power steering test procedures. If necessary replace pump and or motor.
	High internal leakage in steering gear.	Replace steering gear.
Insufficient System Pressure - Caused by Pump	Electrohydraulic power steering system malfunction.	Refer to power steering test procedures.
Insufficient System Pressure - Caused by Steering Gear.	Leaking steering gear piston seals or inner rack seal.	Refer to power steering test procedures. If necessary replace steering gear.

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COMPLAINT	POSSIBLE CAUSE(S)	CORRECTION(S)
Growling Noise in Power Steering Pump.	Excessive back pressure in hoses or steering gear caused by restriction.	Eliminate restriction.
	Scored pressure plate, thrust plate, or rotor.	Replace pump assembly.
	Worn pump ring.	Replace pump assembly.
	Air in power steering fluid.	Add power steering fluid and bleed system.
Rattling Noise in Power Steering Pump.	Vane(s) sticking in rotor slot(s).	Refer to power steering test procedures. If necessary replace pump assembly.
Whining Noise in Power Steering Pump.	Pump shaft being scored.	Refer to power steering test procedures. If necessary replace pump assembly.

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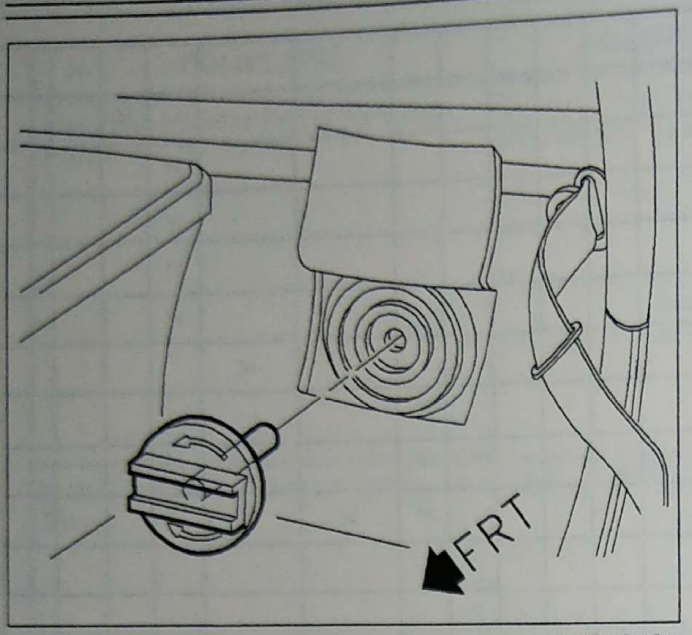
ELECTRO-HYDRAULIC STEERING COMPLAINT – CONDITION CHART

X – Probable cause
POWER STEERING
DIAGNOSIS CHART

COMPLAINT/CONDITION / CAUSE	Hard steering	Poor return of steering wheel to center	Excessive free play in steering	Rattle/clucking noise in steering	Momentary increase in steering w/quick turns	Steering wheel surges/jerks when turning at slow speeds	Insufficient system pressure - caused by steering gear	Growling noise in power steering pump	Rattling noise in power steering pump	Whining noise in power steering pump	
Front tire(s) improperly inflated	X	X									
Improperly adjusted, lubricated, or damaged steering gear	X	X									
Worn or binding ball joints	X			X							
Worn or binding inner or outer tie rod(s)	X	X		X							
Worn or binding upper shock mount											
Worn or binding intermediate shaft joint(s)	X	X	X	X							
Power steering control module (PSCM) or Instrument panel cluster (IPC) not functioning	X										
Power steering fluid low	X				X						
Insufficient power steering pump pressure	X				X	X					
Faulty electrohydraulic power steering (EHPS) pump/motor	X										
Restricted or leaking power steering hose(s)	X										
High internal leakage in steering gear	X										
Excessive front wheel caster	X										
Binding within steering column or intermediate shaft boot	X	X									
Incorrect front wheel caster		X									
Wheel bearing(s) worn			X	X							
Steering gear mounting bolt(s) loose			X	X							
Steering gear out of adjustment or worn			X	X							
Shock bushing(s) worn											
High internal leakage in steering system					X	X					
Damaged handwheel sensor					X						
EHPS electrical circuit/system malfunction					X						
Leaking steering gear piston seals or inner rack seal							X				
Excessive back pressure in hoses or steering gear caused by restriction								X			
Scored pressure plate, thrust plate, or rotor								X			
Worn pump ring								X			
Air in power steering fluid									X		
Vane(s) sticking in rotor slot(s)										X	
Pump shaft being scored											



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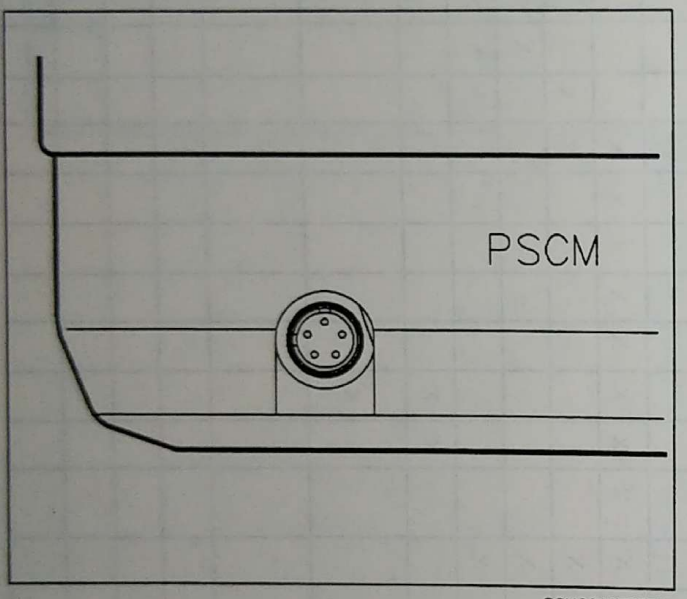

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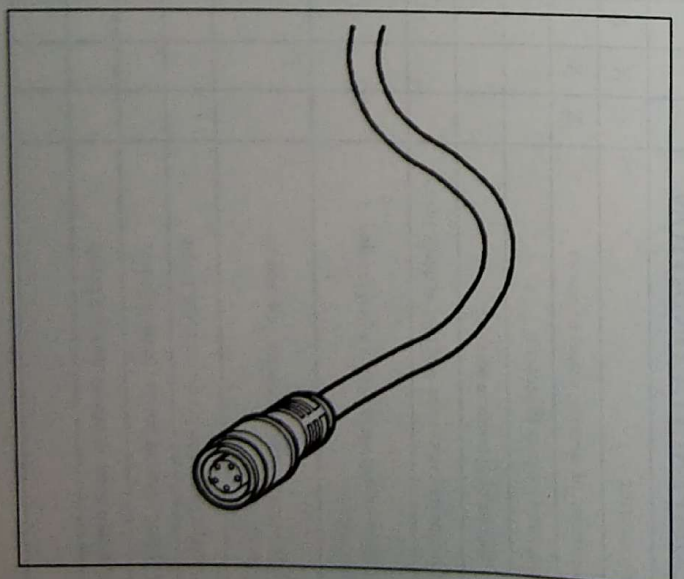

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POWER STEERING SYSTEM TEST PROCEDURE

PRELIMINARY CHECKS

1. Check for **all** diagnostic trouble codes (DTCs). If DTC(s) are present refer to the diagnostic chart for that DTC(s).

CAUTION: IF HTCM DTC 040 IS SET, REFER TO THE DIAGNOSTIC CHART FOR THAT CODE BEFORE PROCEEDING FURTHER. FAILURE TO FOLLOW THIS CAUTION COULD RESULT IN PERSONAL INJURY OR VEHICLE DAMAGE.

2. Does the power steering pump/motor run with the key pad in the run mode and charge coupler removed?

   a. Yes – start at step 5.

   b. No – start at step 3.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

3. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)

4. Disconnect pump/motor wire harness connector from the power steering control module (PSCM). Inspect the five pin male electrical connector at the PSCM. Make sure the connector pin's are not deformed or broken, connector seal is in place and is in good condition. Connection is tight and clean. Inspect cable from the pump/motor assembly to the PSCM for damage.

5. Check power steering pump/motor ground wire and connection at pump and cradle attachments.

6. Check power steering pump/motor ground sensing harness connector, wire and attachment to pump.

7. Check power steering fluid level.

NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

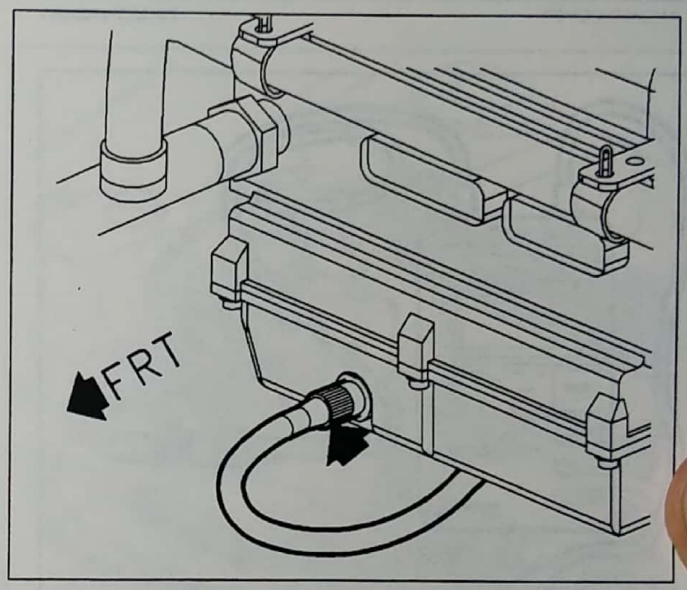
8. Check power steering system for fluid leaks.

9. If all preliminary checks have been completed and no trouble was found go to TEST – 1 "POWER STEERING INSULATION/MEGGER TEST."

TEST 1 – POWER STEERING INSULATION/MEGGER TEST

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Place key pad in the **LOCK** mode.
2. If high voltage system has been disabled, proceed to step 3. If the high voltage system has not been disabled, refer to "High Voltage Disable" procedure in this manual.
3. Disconnect power steering pump/motor wire harness connector from the power steering control module (PSCM).



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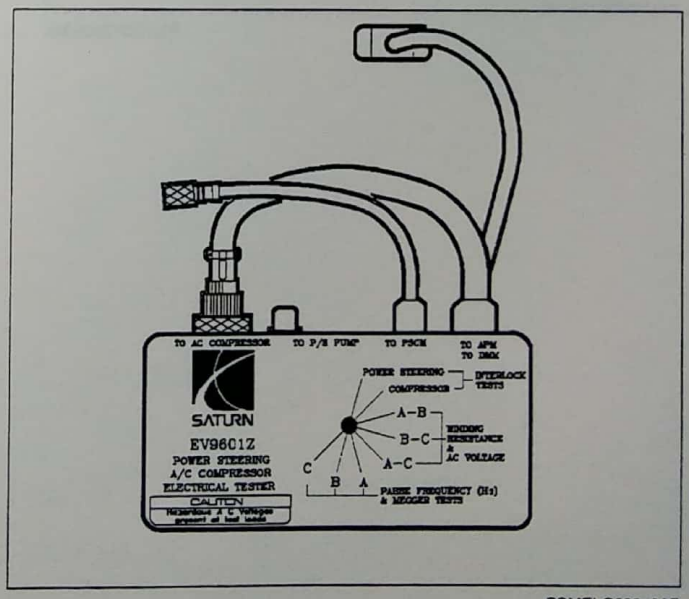
4. Install wire harness connector from power steering pump/motor into EV9701Z (power steering – A/C compressor electrical tester).

NOTICE: Do not connect wire harness connector from EV9701Z into PSCM connector at this time.

NOTICE: Connect A/C compressor lead from EV9701Z into connector on tester. Failure to do this will lead to inaccurate results.

5. Select the MEGGER tests position on EV9701Z.

IMPORTANT: Megger test can be performed at either of the switch points A, B or C.



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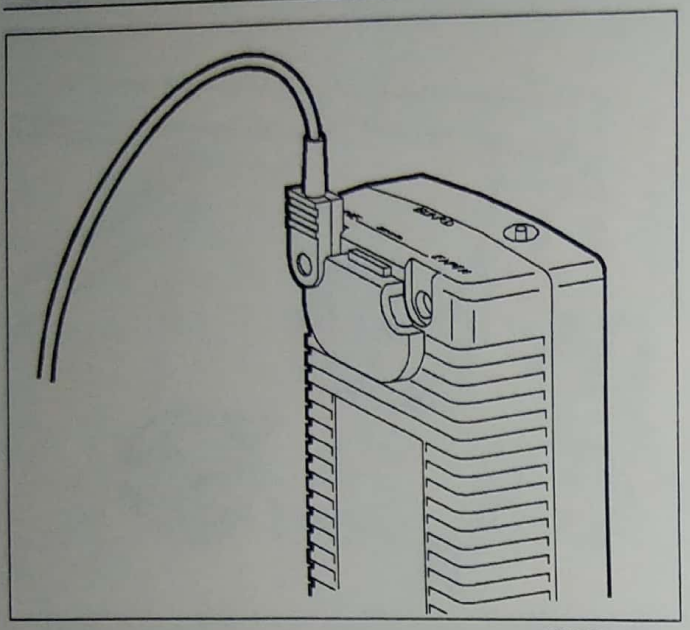

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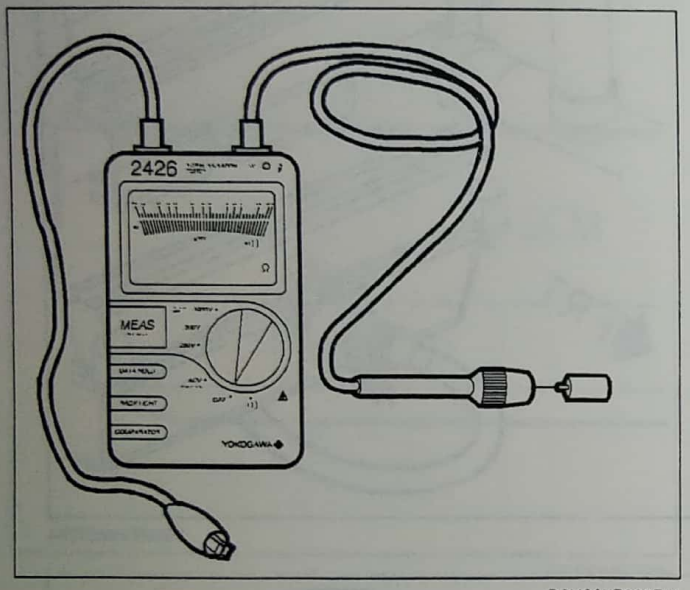
6. Install EV9735Z (Digital Insulation Tester) test leads into the back of tester.
7. Install black wire to EARTH (ground). Orange wire to LINE (line probe).

IMPORTANT: Make sure the leads are fully seated into tester.



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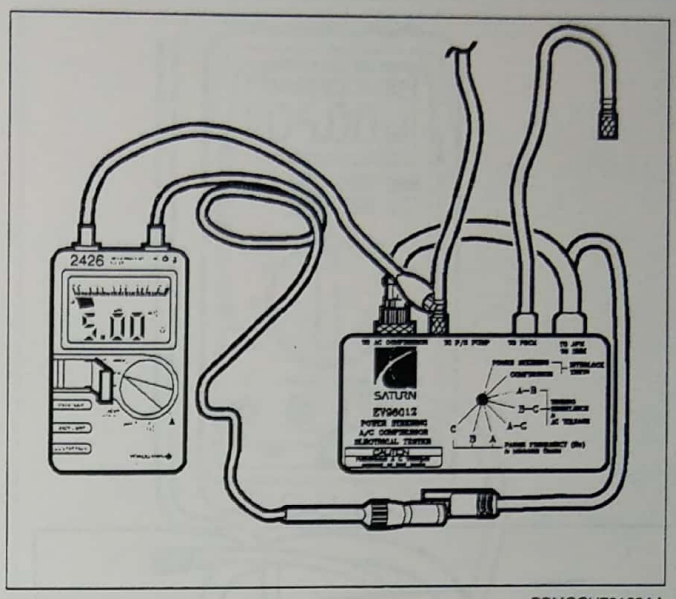
8. Make sure that the DVOM plug adaptor is attached to the line probe (orange wire) on the EV9735Z (Digital Insulation Tester) and connect to the red side of the EV9701Z (power steering – A/C compressor electrical tester) DVOM connector.

9. Connect the EARTH ground (black wire) from the tester to the power steering pump/motor wire harness connector body or power steering pump/motor housing.
10. Set EV9735Z (Digital Insulation Tester) to the 500 volt range.

CAUTION: TO PREVENT SHOCK OR BURNS ALWAYS HAVE METER HOOKED – UP AND IN POSITION TO TAKE MEASUREMENTS. IF NOT MAKE SURE THE PROBE END IS NOT TOUCHING ANYTHING. AS SOON AS THE METER MEASURE HANDLE IS LIFTED THERE IS VOLTAGE POTENTIAL ACROSS THE METER.

11. Lift the meter measure handle on EV9735Z. Notice the High Voltage LED is on in the right – top corner. This indicates high voltage is present on the tool.



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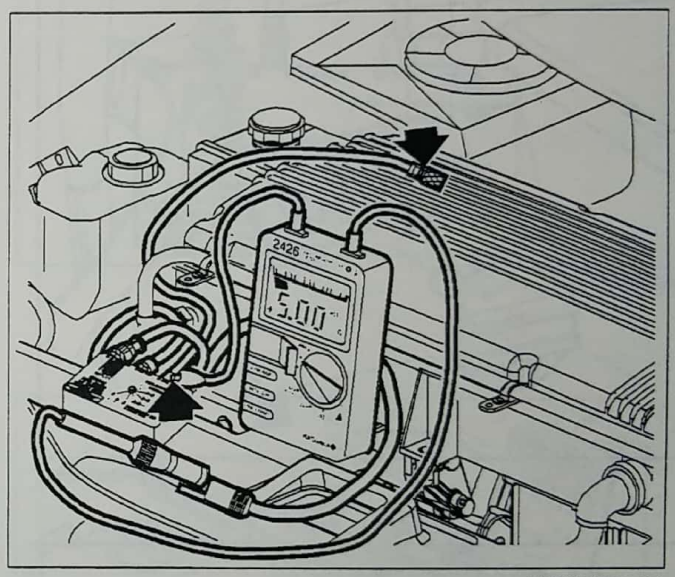
12. With the meter measure handle lifted, view/record measurement on tester.
13. Reading should be between 5.0 MΩ (5.0 MEG–OHMS) and infinity (0L).
14. If reading is not within the range listed in step 13, replace power steering pump/motor assembly.
15. If reading falls within the range listed in step 13, refer to "Test 2 – POWER STEERING ELECTRICAL TEST" in this manual.



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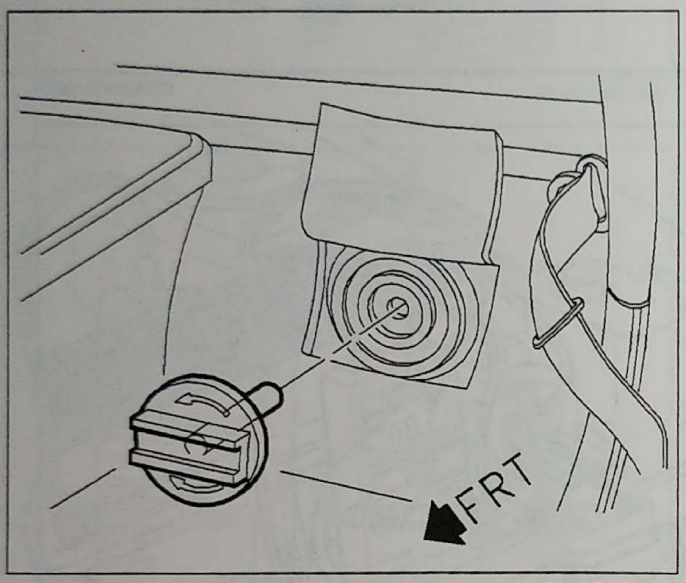
TEST 2 – POWER STEERING ELECTRICAL TEST

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. If high voltage system has been disabled, proceed to step 3. If high voltage has not been disabled, refer to "High Voltage Disable" in this manual.
2. Place key pad in the **LOCK** mode.



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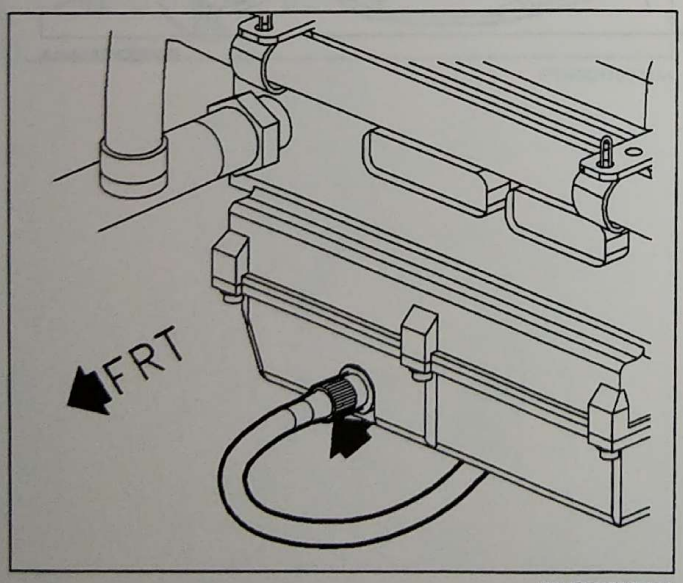

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3. Disconnect power steering pump/motor wire harness connector from the power steering control module (PSCM).

4. Install wire harness connector from power steering pump/motor into EV9701Z (power steering – A/C compressor electrical tester).
5. Connect digital multimeter (DVOM) lead from EV9701Z into DVOM.

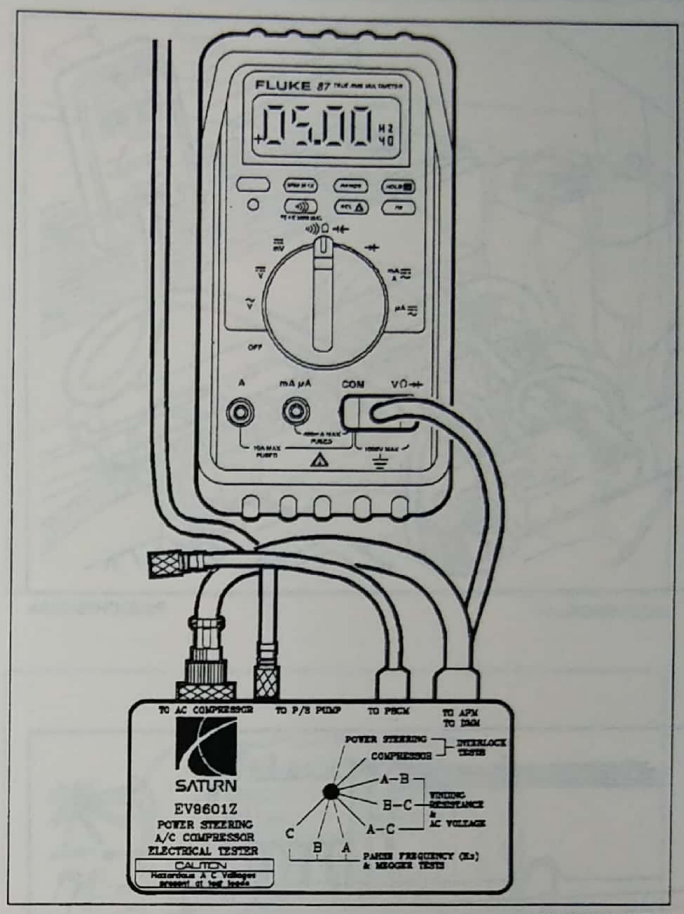
IMPORTANT: Do not connect wire harness connector from EV9701Z into PSCM connector at this time.

NOTICE: When using a multimeter on the ohmmeter scale, make sure the circuit or component is disconnected from a power source. Applying voltage to a multimeter when you are measuring resistance can damage the multimeter.

6. Set DVOM to the ohmmeter setting.

IMPORTANT: Do not turn steering wheel while performing this test. This will lead to inaccurate results.

7. Measure power steering motor winding resistance at switch points A–B, B–C, A–C and power steering INTER-LOCK.
8. Resistance at switch points A–B, B–C, and A–C should be between 3–6 ohms at normal/typical operating temperature, 37 to 50 degrees C. (100 to 120 degrees F.).
9. Resistance at switch point power steering INTER-LOCK should be less than 1.0 ohm at normal/typical operating temperature, 37 to 50 degrees C. (100 to 120 degrees F.).
10. If resistance readings do not fall within range listed in steps 8 and 9, replace power steering motor.
11. If resistance readings fall within the range listed in steps 8 and 9, go to step 12.



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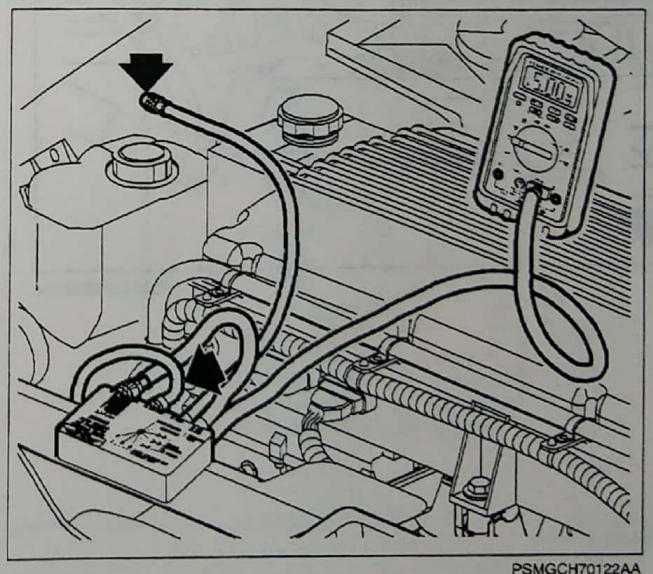
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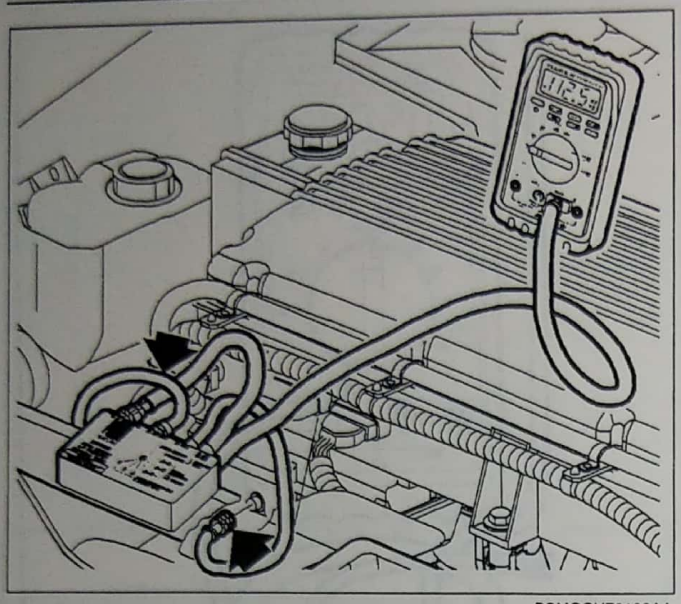
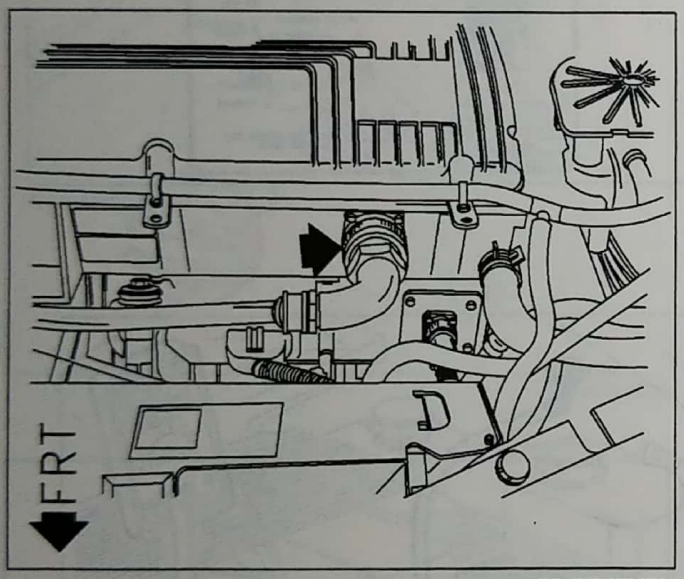


PSMGCH70123AA

12. Install wire harness from EV9701Z to the PSCM five pin connector.

NOTICE: Make sure wire harness connector from EV9701Z (power steering electrical tester) is properly aligned to the connection at the PSCM prior to installation, this will help avoid damaging connector pin's.

NOTICE: Connect A/C compressor lead from APM outlet on tester into A/C compressor connector on tester. Failure to do this will lead to inaccurate results.



PSMPEN65997AA

13. Set DVOM to the AC volts setting.
14. Reinstall the charge receptacle to PIM connector.

IMPORTANT: Do not use any tools to reinstall the connector. Excessive force or misalignment can damage the connector.

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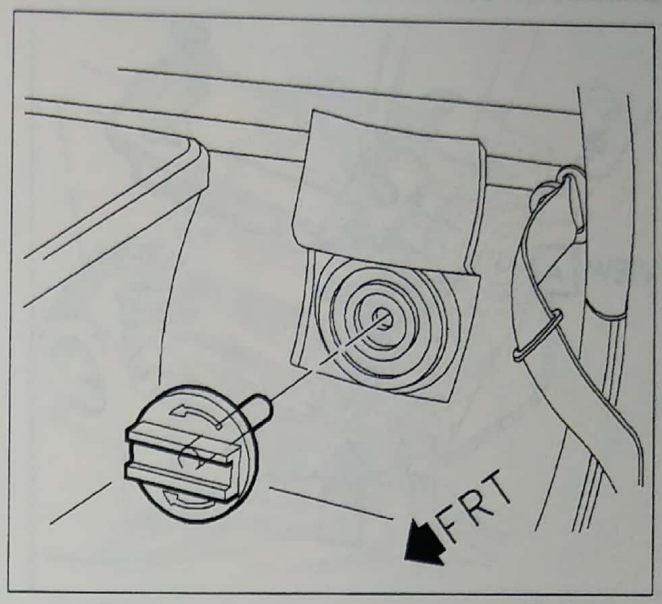
15. Install the manual disconnect handle by pushing the shaft straight into the hole and turning clockwise.
16. Power vehicle up and clear BPM codes. If the vehicle does not power-up, refer to the "High Voltage" section of this manual.



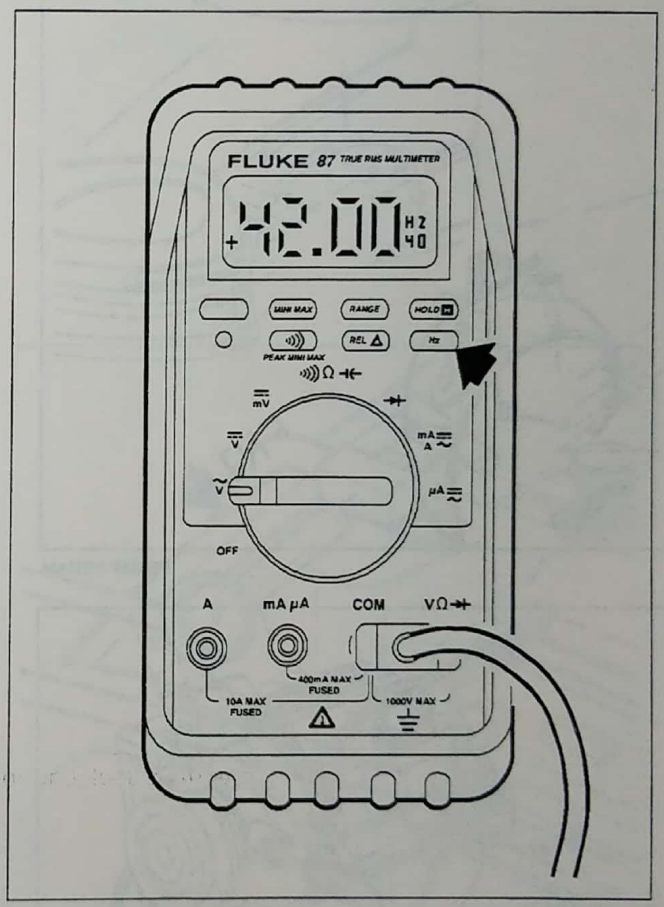
PSMPEN65995AA

17. Place keypad in RUN mode. Remove charge coupler if installed. Wait 10 minutes before taking any readings. This is necessary to allow system temperature to stabilize.

CAUTION: THE EV9701Z POWER STEERING – A/C COMPRESSOR ELECTRICAL TESTER, LEADS AND DVM NOW CONTAIN 180 VOLTS, AC.

IMPORTANT: Do not turn steering wheel while performing this test. This will lead to inaccurate results.

18. Measure AC volts at switch points A–B, B–C, A–C.
19. AC voltage at switch points A–B, B–C, A–C should be between 100–115 volts AC.
20. If voltage readings do not fall within the range listed in step 19, refer to "Power Steering Diagnostic Chart 1" in this manual.
21. If voltage readings fall within the range listed in step 19, go to step 22.
22. Select AC volts on DVM. Select Hz and a range of 40.
23. Measure frequency in Hz at switch points A, B and C.
24. Frequency (Hz) at switch points A, B and C should be between 38–46 Hz.
25. If frequency readings do not fall within the range listed in step 24, refer to "Power Steering Diagnostic Chart 1" in this manual.
26. If frequency readings fall within the range listed in step 24, refer to "Test 3 – POWER STEERING SYSTEM HYDRAULIC TEST" in this manual.



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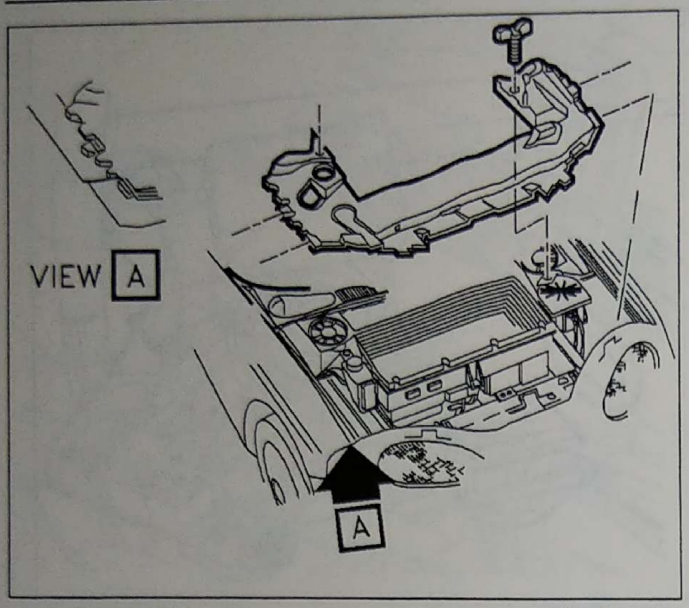
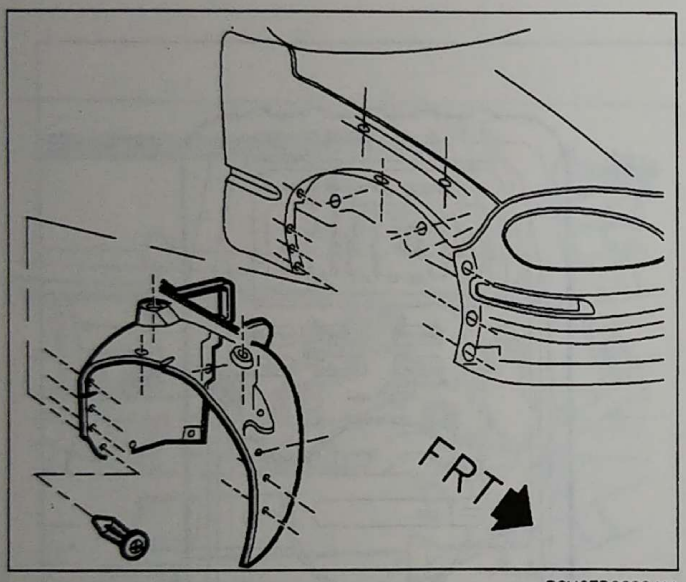


PSMGEP65869AC

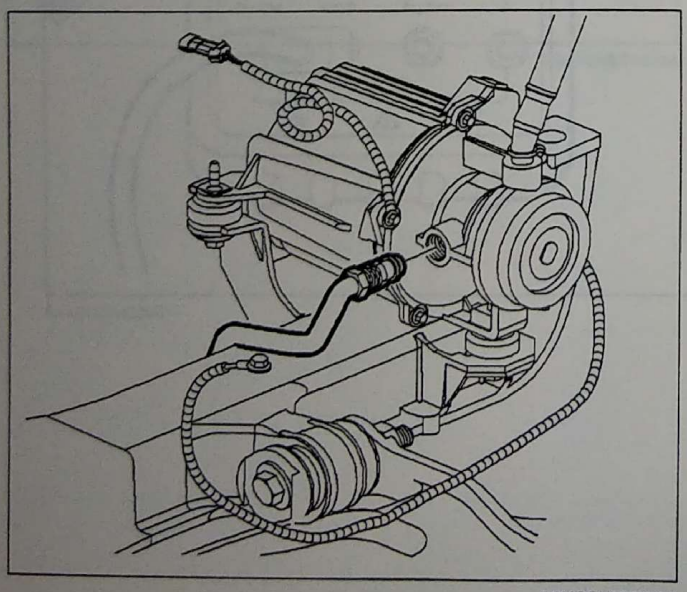
TEST 3 – POWER STEERING SYSTEM HYDRAULIC TEST

1. Place keypad in OFF mode.
2. Remove engine compartment sight shield. Raise vehicle on a hoist. (Refer to "Lifting, Jacking, and Support Points" section in this service manual).



PSMGEP66024AA

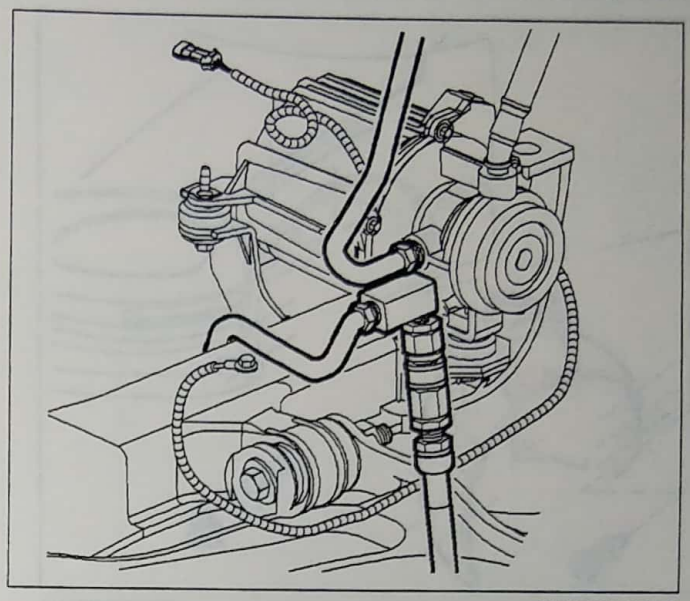
3. Remove right front road wheel and wheel house liner.



PSMGCH70089AA

4. Disconnect high pressure line at the pump/motor assembly.

5. Install power steering analyzer EV9707C (or equivalent).
6. Open the gate valve on the power steering system tester.
7. Place keypad in run mode and run the pump motor until it has reached normal/typical operating temperature, 37 to 50 degrees C (100 to 120 degrees F).
8. Replace any power steering fluid lost during power steering tester installation.
9. Bleed system if necessary. (Refer to "Power Steering System bleed" procedures in the Service Manual).



PSMGCH70091AA

NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

10. With the vehicle in the power save mode (vehicle in the run mode for 10 seconds and no handwheel or vehicle speed input), record the power steering fluid pressure and flow rate.
    a. If the pressure reading is greater than 345 kPa (50 psi), turn Off the vehicle and check the power steering lines for restrictions or pinch points.
    b. If pressure reading is less than 345 kPa (50 psi), proceed to next step.

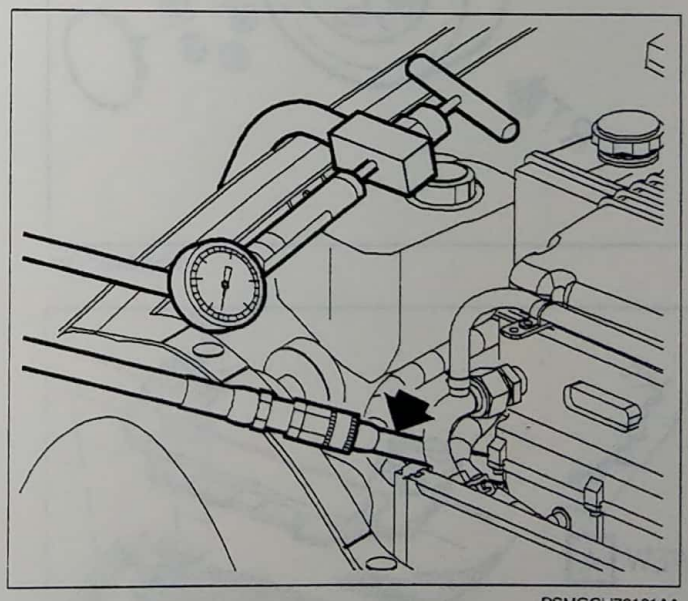
IMPORTANT: Do not turn steering wheel while performing this test. This will lead to inaccurate results.

11. Slowly close the gate valve until 2760 kPa (400 psi) is indicated on the power steering analyzer pressure gage.
12. Record the power steering fluid pressure and flow rate. The flow rate observed should not be less than 1.20 liters/minute (0.31 gpm). If a lower flow rate is recorded, replace the pump.

IMPORTANT: Do not turn steering wheel while performing this test. This will lead to inaccurate results.

NOTICE: Do not close the gate valve for more than five seconds at a time. This may damage the power steering pump/motor assembly.

13. Fully close and open the gate valve three times.
14. Record the power steering fluid pressure each time with the valve closed.
    a. All three readings should be at a minimum of 4481 kPa (650 psi), with a maximum variation of 689 kPa (100 psi).
    b. If not replace the pump/motor assembly.
15. Open gate valve.



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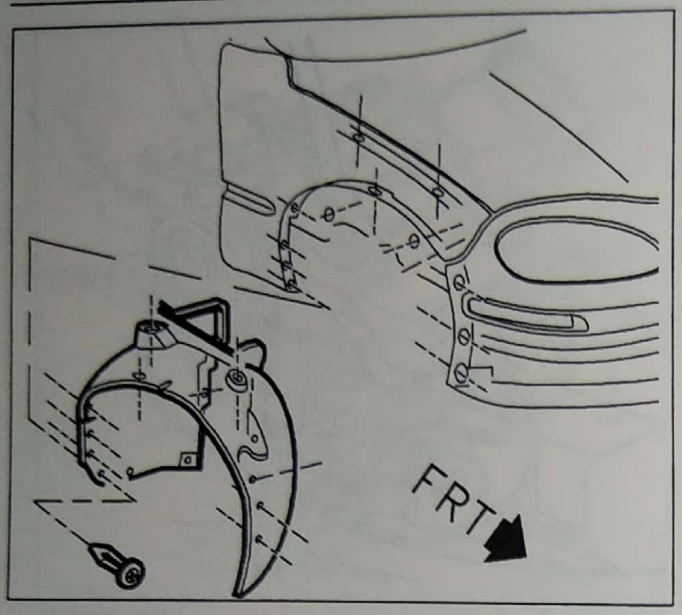
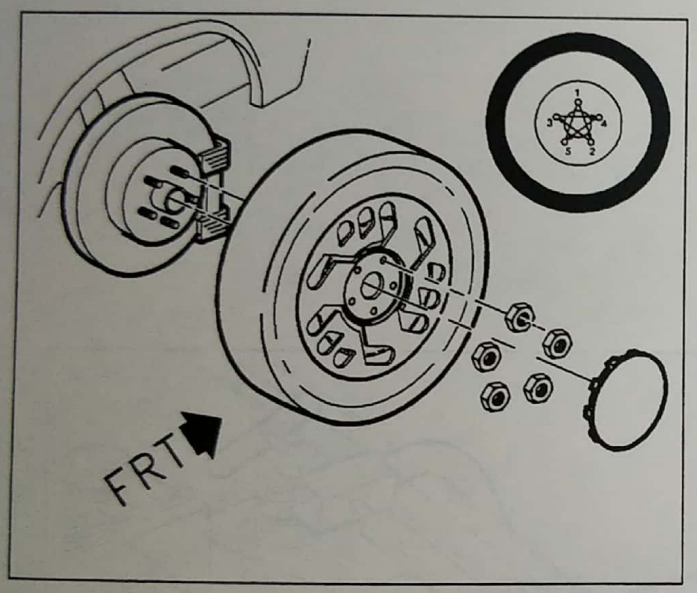


PSMGEP66024AA

16. Turn the steering wheel all the way to the left, then all the way to the right. Record the power steering fluid pressure and flow rate at each stop.
    a. If the flow is greater than 1.9 liters/minute (0.5 gpm) at either stop, the steering gear is leaking internally and must be replaced.
17. After testing and or repairs:
    a. Remove power steering analyzer.
    b. Install wheel house liner

Torque: 6 N•m (53 in−lbs)



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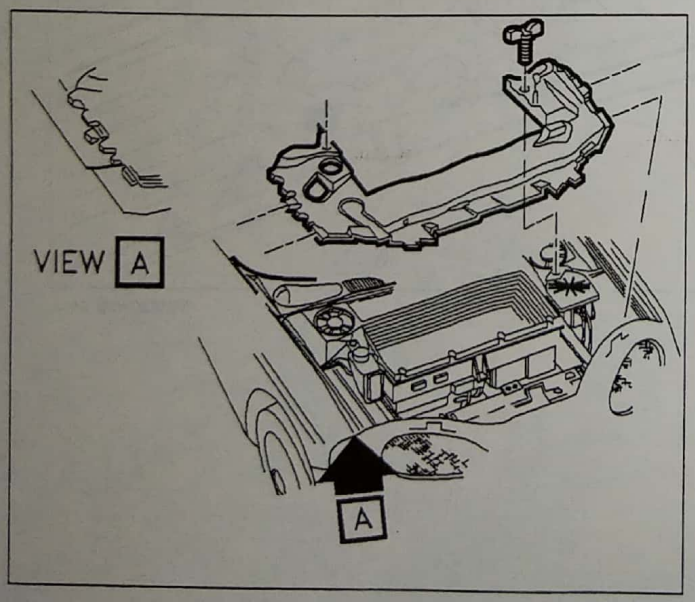
    c. Install road wheel(s), lower vehicle.

Torque: 120 N•m (89 ft−lbs)



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    d. Install engine compartment sight shield.
18. Check power steering fluid level.

NOTES

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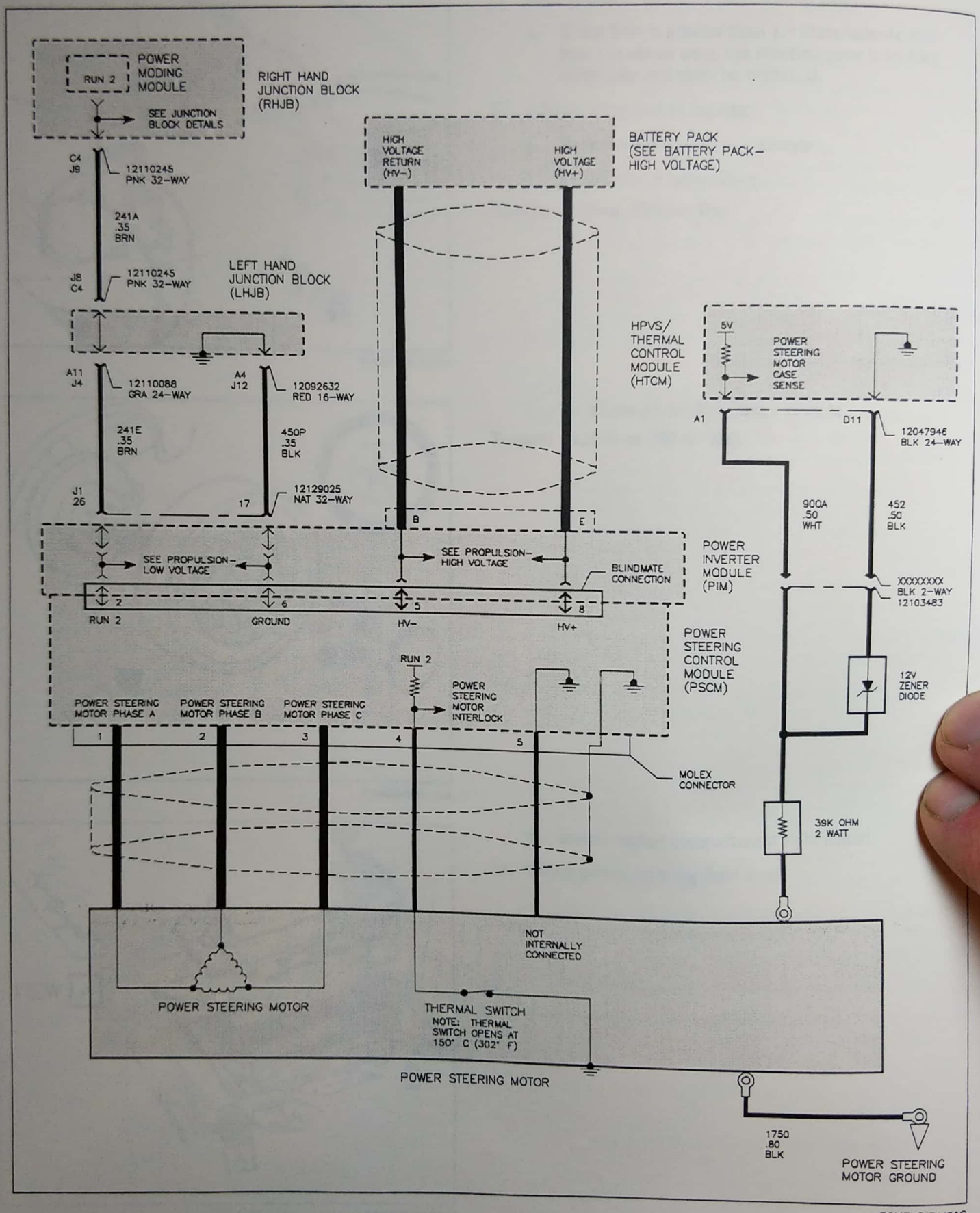
POWER STEERING SCHEMATIC



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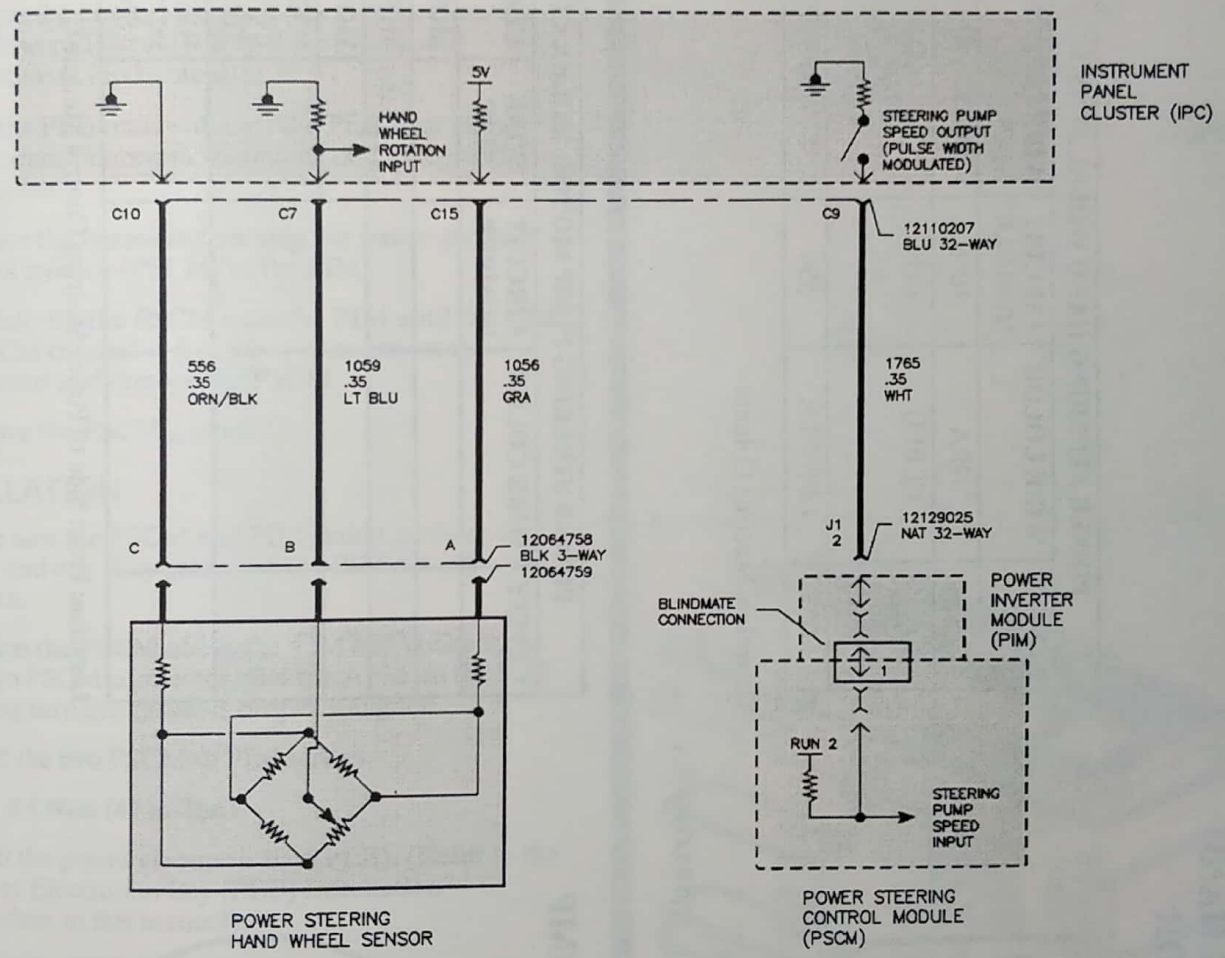

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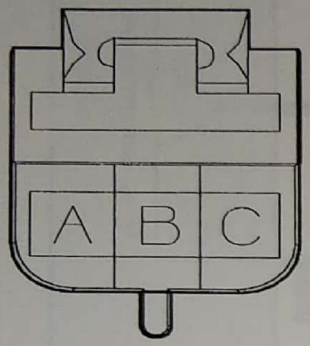
HARNESS CONNECTOR FACES

POWER STEERING HAND WHEEL SENSOR



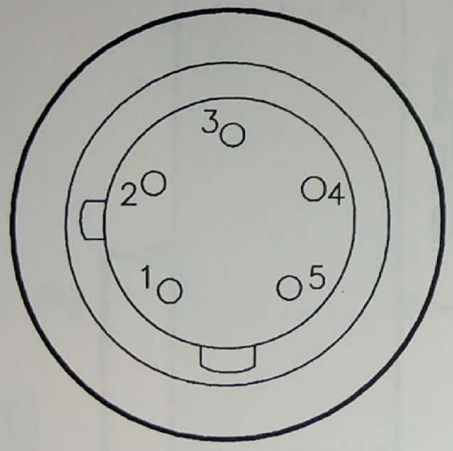
BLACK
12064758

PSMELC66033AA

POWER STEERING HAND WHEEL SENSOR – 12064758				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	GRA	1056	.35	+5 REF
B	LT BLU	1059	.35	HAND WHEEL ROTATION SIGNAL OUT
C	ORN/BLK	556	.35	GROUND

Location: Steering Column

POWER STEERING PUMP MOTOR



YELLOW
MOLEX CONNECTOR

PSMELC66464AB

POWER STEERING PUMP MOTOR MOLEX CONNECTOR				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
1				MOTOR PHASE A
2				MOTOR PHASE B
3				MOTOR PHASE C
4				HIGH VOLTAGE + INTERLOCK CIRCUIT
5				HIGH VOLTAGE – INTERLOCK CIRCUIT

Location: Front Side of Power Steering Control Module

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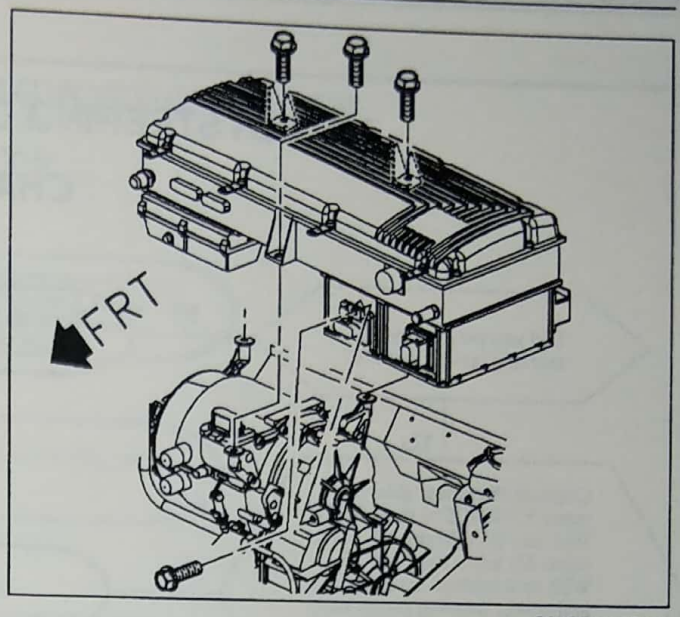
POWER STEERING CONTROL MODULE

REMOVAL

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Remove the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Removal" procedure in this manual).
2. With the PEB removed, turn the PEB over onto a soft surface to prevent scratching or damaging the PEB cover.
3. Remove the fasteners retaining the power steering control module (PSCM) to the PIM.
4. Carefully lift the PSCM from the PIM until the PIM to PSCM connector is in view. Disconnect the connector and remove the PSCM.
5. Remove the PSCM gasket.



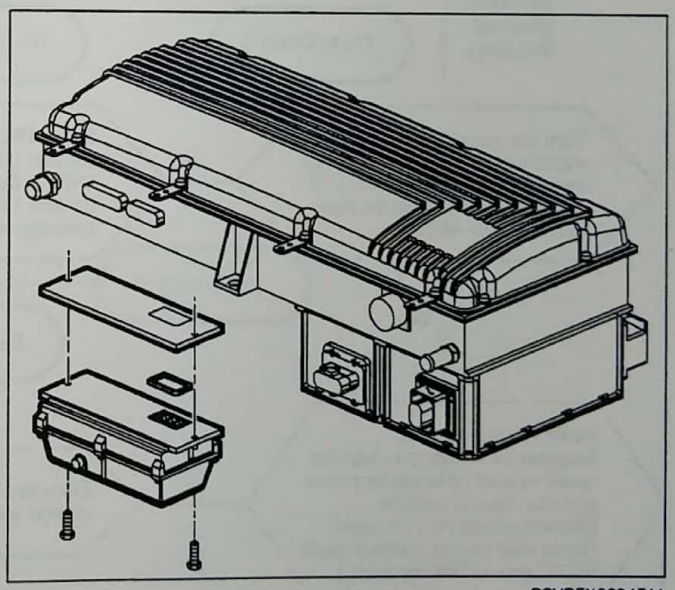
PSMPEN65834AA

INSTALLATION

1. Make sure the PSCM and PIM gasket surfaces are clean and dry. Lay gasket on the PIM mating surface.
2. Position the PSCM above the PIM and connect the PIM to PSCM connector. Set the APM on the PIM making sure the gasket is properly aligned.
3. Install the two PSCM to PIM screws.

Torque: 5.5 N•m (49 in–lbs.)

4. Install the power electronic bay (PEB). (Refer to the "Power Electronics Bay (PEB) Installation" procedure in this manual).



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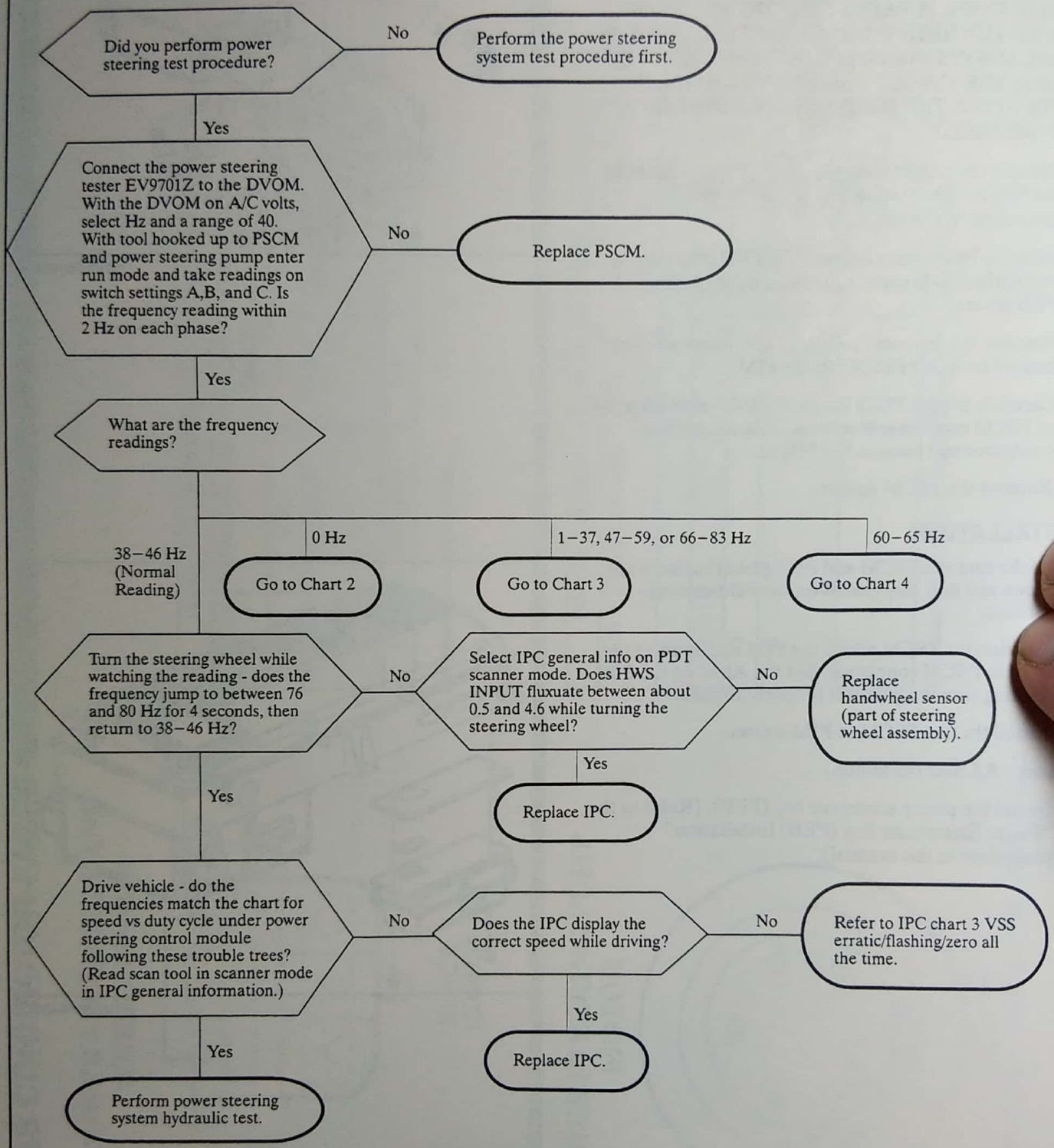
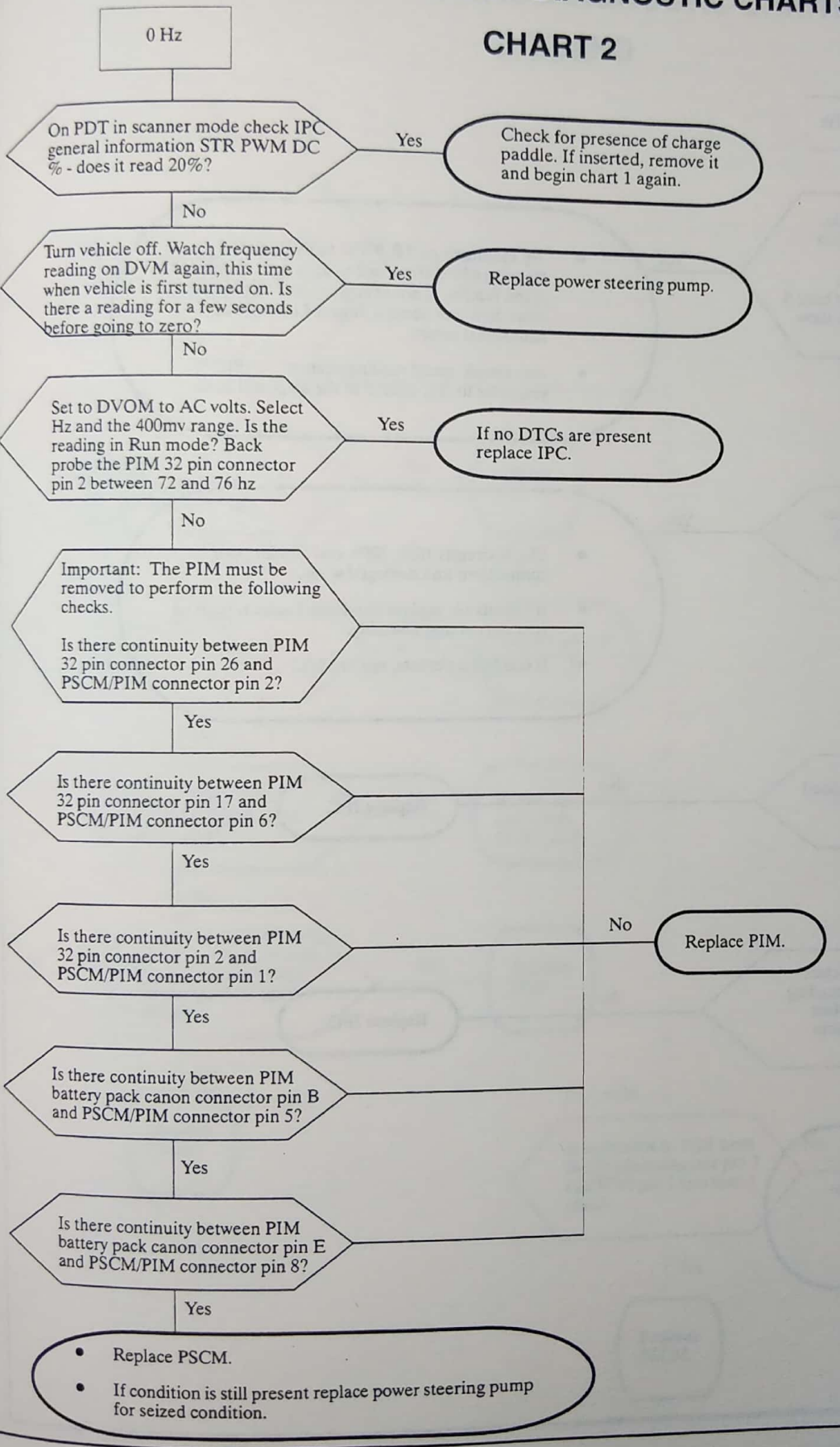
POWER STEERING DIAGNOSTIC CHARTS

CHART 1


Did you perform power steering test procedure?
No
Perform the power steering system test procedure first.
Yes
Connect the power steering tester EV9701Z to the DVOM. With the DVOM on A/C volts, select Hz and a range of 40. With tool hooked up to PSCM and power steering pump enter run mode and take readings on switch settings A,B, and C. Is the frequency reading within 2 Hz on each phase?
No
Replace PSCM.
Yes
What are the frequency readings?
0 Hz
1–37, 47–59, or 66–83 Hz
60–65 Hz
38–46 Hz (Normal Reading)
Go to Chart 2
Go to Chart 3
Go to Chart 4
Turn the steering wheel while watching the reading - does the frequency jump to between 76 and 80 Hz for 4 seconds, then return to 38–46 Hz?
No
Select IPC general info on PDT scanner mode. Does HWS INPUT fluxuate between about 0.5 and 4.6 while turning the steering wheel?
No
Replace handwheel sensor (part of steering wheel assembly).
Yes
Replace IPC.
Yes
Drive vehicle - do the frequencies match the chart for speed vs duty cycle under power steering control module following these trouble trees? (Read scan tool in scanner mode in IPC general information.)
No
Does the IPC display the correct speed while driving?
No
Refer to IPC chart 3 VSS erratic/flashing/zero all the time.
Yes
Replace IPC.
Yes
Perform power steering system hydraulic test.

POWER STEERING DIAGNOSTIC CHARTS

CHART 2


0 Hz
On PDT in scanner mode check IPC general information STR PWM DC % - does it read 20%?
Yes
Check for presence of charge paddle. If inserted, remove it and begin chart 1 again.
No
Turn vehicle off. Watch frequency reading on DVM again, this time when vehicle is first turned on. Is there a reading for a few seconds before going to zero?
Yes
Replace power steering pump.
No
Set to DVOM to AC volts. Select Hz and the 400mv range. Is the reading in Run mode? Back probe the PIM 32 pin connector pin 2 between 72 and 76 hz
Yes
If no DTCs are present replace IPC.
No
Important: The PIM must be removed to perform the following checks.
Is there continuity between PIM 32 pin connector pin 26 and PSCM/PIM connector pin 2?
Yes
Is there continuity between PIM 32 pin connector pin 17 and PSCM/PIM connector pin 6?
Yes
Is there continuity between PIM 32 pin connector pin 2 and PSCM/PIM connector pin 1?
No
Replace PIM.
Yes
Is there continuity between PIM battery pack canon connector pin B and PSCM/PIM connector pin 5?
Yes
Is there continuity between PIM battery pack canon connector pin E and PSCM/PIM connector pin 8?
Yes
• Replace PSCM.
• If condition is still present replace power steering pump for seized condition.

POWER STEERING DIAGNOSTIC CHARTS

CHART 3

1–37, 47–59, or 66–83 Hz

On PDT in EV scanner mode, select IPC general information

With vehicle in park and not moving steering wheel for at least 5 seconds, does STR PWM % show 48%?

Yes

- Try monitoring STR PWM % while turning steering wheel from lock to lock several times. If the reading is not changing smoothly up and down between about 0.5v and 4.6v, replace handwheel sensor.
- Any erratic speed reading changes on IPC? If yes, refer to IPC chart 3 in the electrical book.

No

Watch IPC general information 'HWS INPUT' does it change intermittently by itself?

Yes

- Check circuits 1056, 1059, and 556 for poor connections and damaged wires.
- If circuits ok, replace handwheel sensor. (part of steering column assembly.
- If condition persists, replace IPC

No

Is the IPC registering some speed without the vehicle moving?

No

Replace IPC.

Yes

Set to DVOM to AC volts. Select Hz and the 400mv range. Is reading something other than zero when IPC registers speed with vehicle stationary?

No

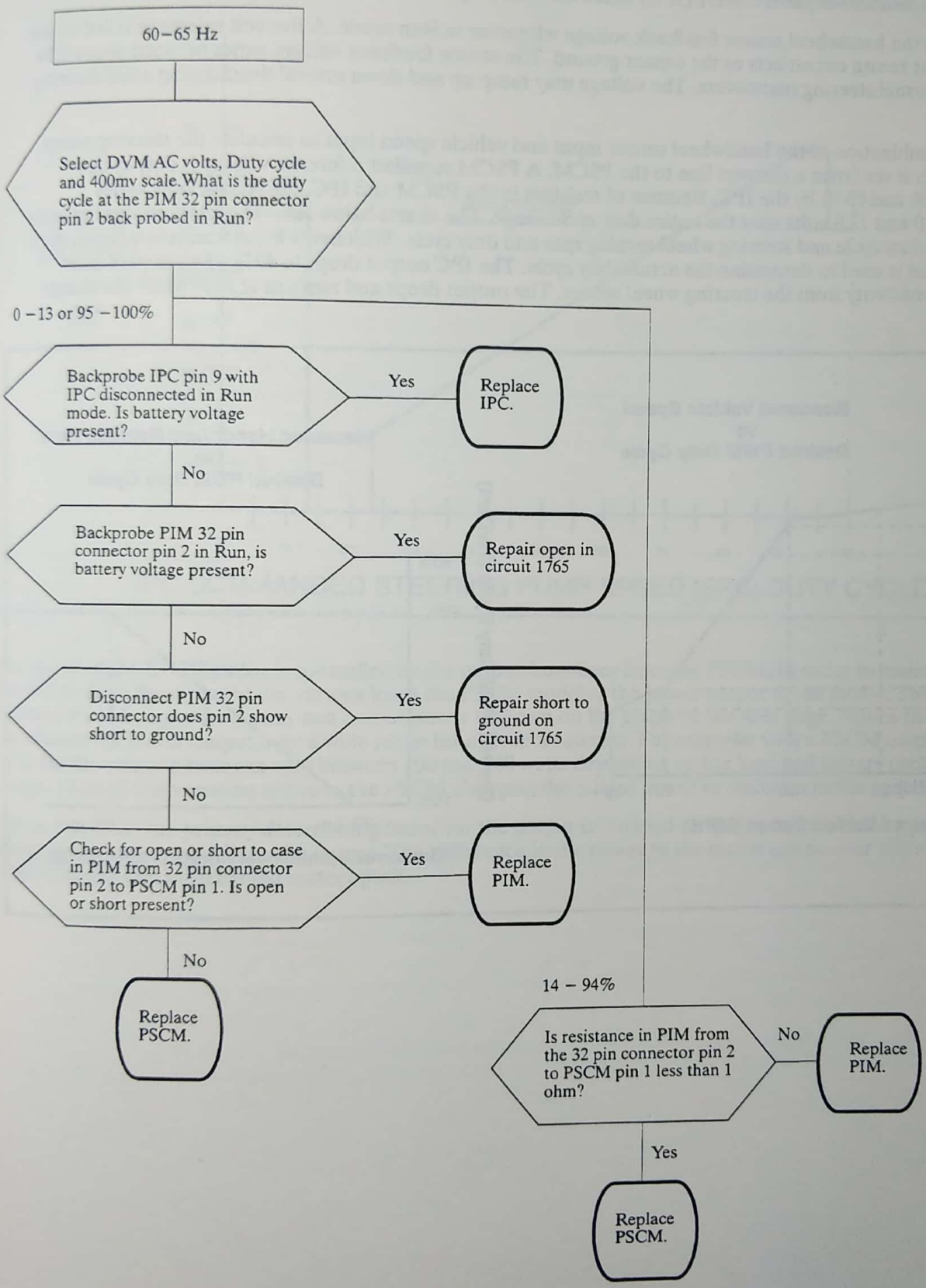
Replace IPC.

Yes

- Check circuit 389 for running close to high voltage circuits or damage to wire.
- If circuit ok, replace PIM.

POWER STEERING DIAGNOSTIC CHARTS

CHART 4

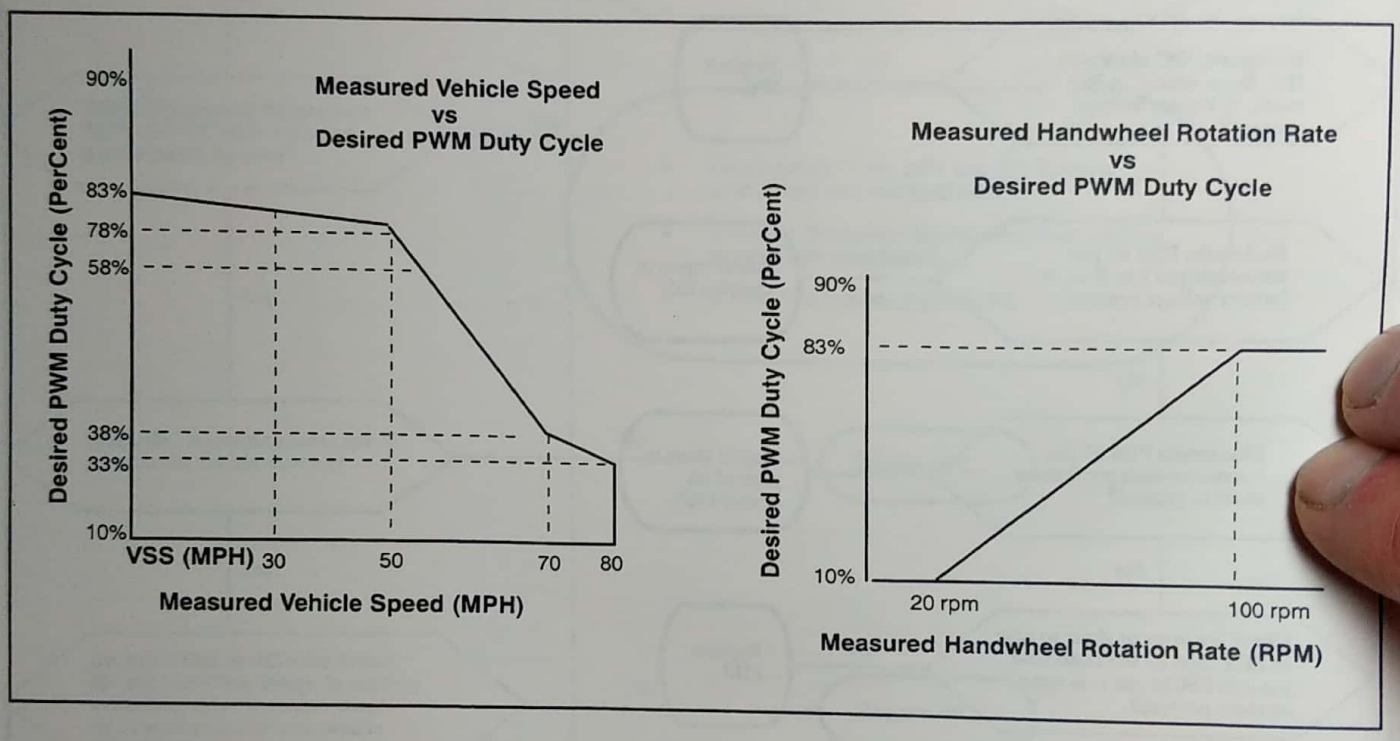

60–65 Hz
Select DVM AC volts, Duty cycle and 400mv scale. What is the duty cycle at the PIM 32 pin connector pin 2 back probed in Run?
0 –13 or 95 –100%
Backprobe IPC pin 9 with IPC disconnected in Run mode. Is battery voltage present?
Yes
Replace IPC.
No
Backprobe PIM 32 pin connector pin 2 in Run, is battery voltage present?
Yes
Repair open in circuit 1765
No
Disconnect PIM 32 pin connector does pin 2 show short to ground?
Yes
Repair short to ground on circuit 1765
No
Check for open or short to case in PIM from 32 pin connector pin 2 to PSCM pin 1. Is open or short present?
Yes
Replace PIM.
No
Replace PSCM.
14 – 94%
Is resistance in PIM from the 32 pin connector pin 2 to PSCM pin 1 less than 1 ohm?
No
Replace PIM.
Yes
Replace PSCM.

POWER STEERING CONTROL MODULE

The purpose of the power steering control module (PSCM) is to control the power steering pump (electrohydraulic power steering [EHPS] motor). The PSCM controls the speed of the EHPS motor, which determines power steering assist. Power steering assist is controlled to meet driving requirements. The amount of power steering assist is determined by the instrument panel cluster (IPC) based on vehicle speed and steering wheel rotation speed.

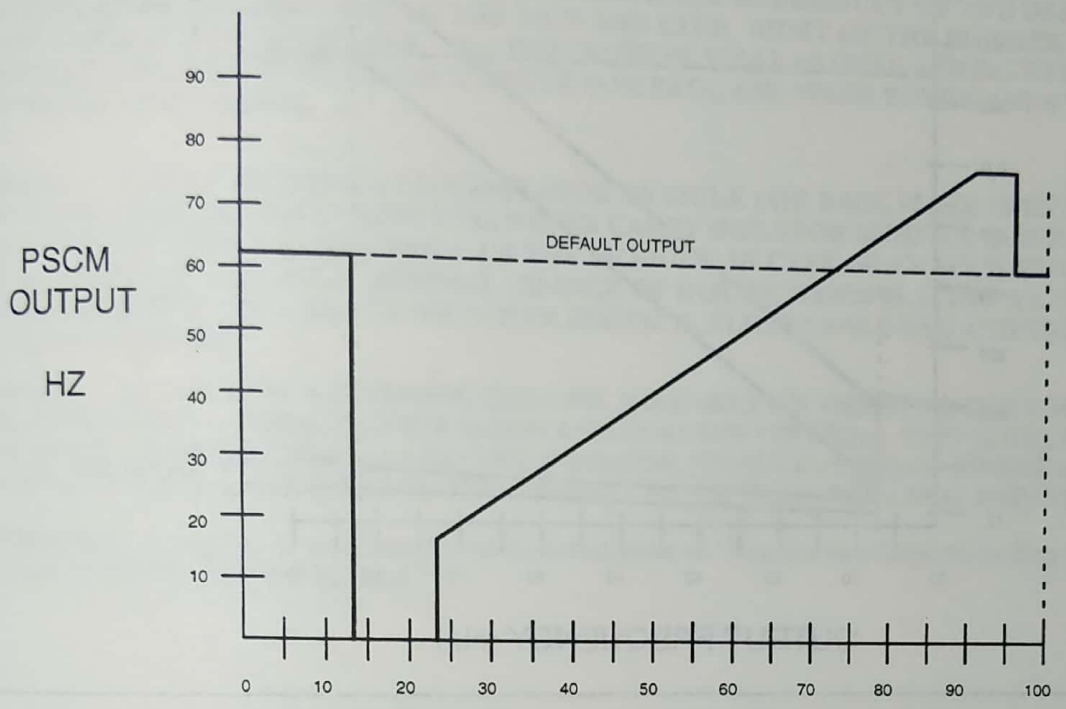
The IPC monitors the handwheel sensor feedback voltage whenever in Run mode. A five volt reference is fed to the sensor and a sensor return circuit acts as the sensor ground. The sensor feedback voltage varies between about 0.5v and 4.6v during normal steering maneuvers. The voltage may ramp up and down several times during a full steering maneuver.

The IPC uses a combination of the handwheel sensor input and vehicle speed input to calculate the steering pump speed signal, which is sent over a discreet line to the PSCM. A PSCM supplied reference voltage is duty cycled between about 20% and 83 % by the IPC. Because of resistors in the PSCM and IPC, the voltage only varies between about 11.0 and 12.8 volts over the entire duty cycle range. The charts below show the relationships between vehicle speed and duty cycle and steering wheel turning rpm and duty cycle. Whichever input results in a larger duty cycle at a given time is used to determine the actual duty cycle. The IPC output drops to 48% when in park after four seconds of nonactivity from the steering wheel sensor. The output drops and remains at 20% while the charge paddle is inserted



The IPC sends a duty cycle signal to the PSCM is shown in the graph below.

If the signal from the IPC is out of range < 5% or > 87% the PSCM defaults to 62 Hz output. The PSCM turns the motor Off when the IPC sends a 77% to 87% duty cycle signal.



IPC COMMANDED STEERING PUMP SPEED (SPS) DUTY CYCLE

The speed of the EHPS motor is controlled by the output frequency from the PSCM. In order to maintain the power needed to drive the motor under various loads the PSCM modifies the power output to the motor. The relationship between PSCM output frequency and output power is shown on the graph on the next page. Notice that the PSCM can change the power output over a wide range for a given frequency. For example: with a PSCM output frequency of 82 Hz the output power can vary between 100 and 900 watts depending on the load and battery pack state of charge. Most of this variation is due to the PSCM changing the output power to maintain motor speed.

Notice that while the primary determining factor for the output is the load on the motor, the battery pack state of charge also significantly affects the output. The difference in the power to the motor can be over 100 watts between a fully charged and a discharged battery pack.

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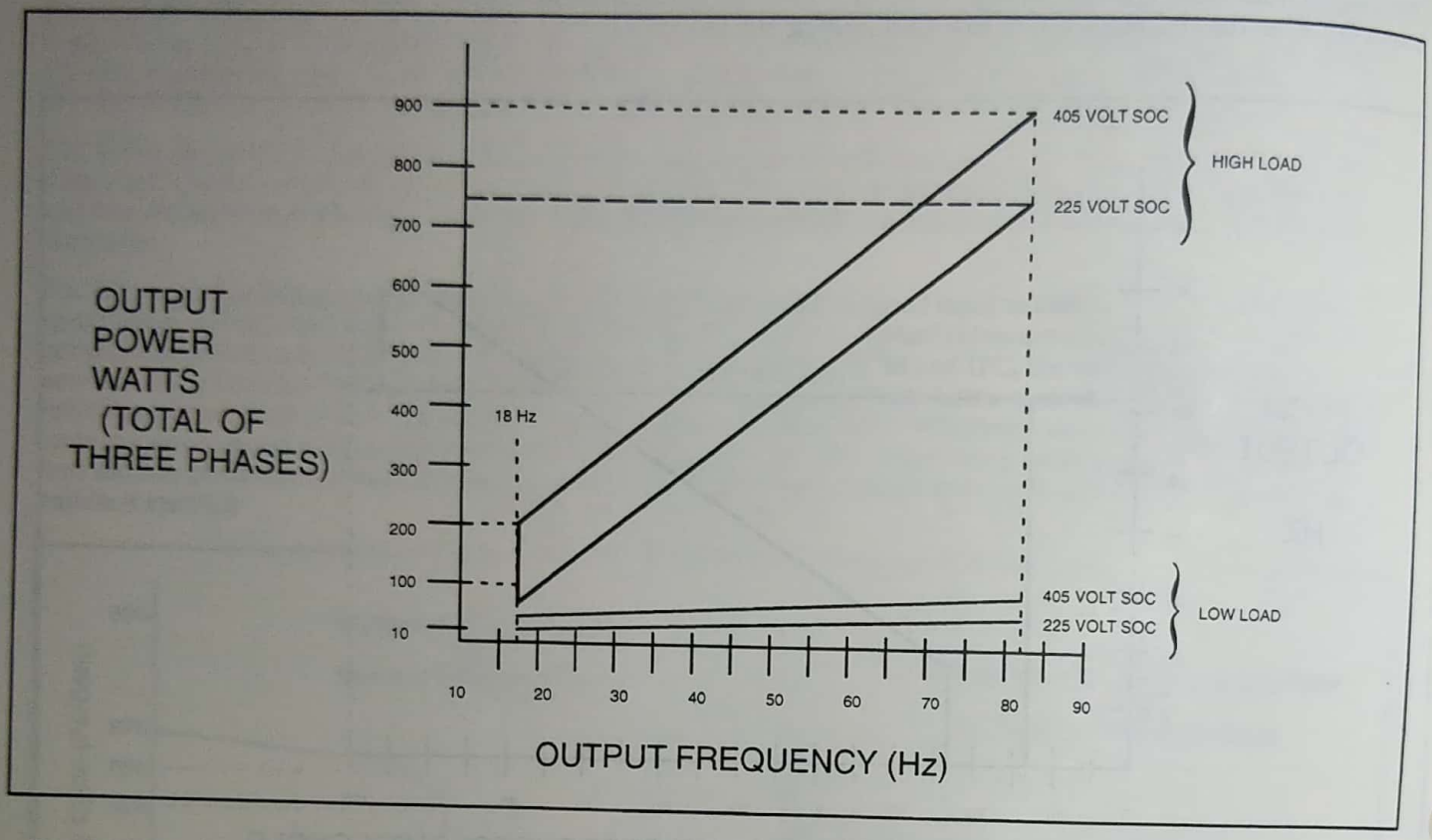

The PSCM turns on whenever there is 12 volts on the secondary run power circuit 241. This circuit is powered by the right hand junction block (RHJB) when a Run command is issued by the RSA. The 241A circuit runs from the RHJB circuit to the left hand junction block (LHJB) and then turns into 241E to the power inverter module (PIM). The circuit divides in the PIM and feeds both the propulsion control module (PCM) and PSCM. This voltage powers the internal PSCM circuitry. The 12 volt ground for the PSCM runs through the PIM to the LHJB.

High voltage DC power and return come through the PIM from either the battery pack or charge receptacle, depending on the mode of operation. The PSCM inverts and transforms the DC high voltage into three phase AC voltage to drive the pump motor. This voltage varies between 0 and 180 VAC.

The high voltage interlock loop passes from the PIM through the PSCM in addition to the Accesory AC and DC power control module (APM) and PCM. If the PSCM (or any of the other modules in the loop) are disconnected or have an open in this circuit, high voltage is shut off and codes are set. Diagnosis of an open interlock loop should be performed by following the trouble trees for the codes set.

There is another interlock loop that affects only the PSCM operation. It consists of wiring to and from the EHPS motor and a thermal switch in the EHPS motor. The switch opens if the motor overheats (150°C [302°F]). If the loop opens the PSCM will stop three phase power to the motor until loop continuity is restored and the vehicle (Run 2 voltage) is cycled Off and back On.

The PSCM watches the power output to the EHPS motor. If it determines there is an over current, over temperature, or other fault condition, power to the EHPS motor will be shut Off until Run 2 power is cycled Off and back On again.

DRIVER INFLATOR MODULE (AIR BAG)

NOTICE: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG). AFTER DEPLOYMENT, THE INFLATOR MODULE (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE INFLATOR MODULE (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG), AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

NOTICE: WHEN CARRYING A LIVE INFLATOR MODULE (AIR BAG), MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY INFLATOR MODULE (AIR BAG) BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE INFLATOR MODULE (AIR BAG) ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

NOTICE: NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE INFLATOR MODULE (AIR BAG) FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE INFLATOR MODULE (AIR BAG) TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

IMPORTANT: In the event deployment has occurred, refer to "Repairs and Inspections Required After an Accident" in the "SIR Service Manual."

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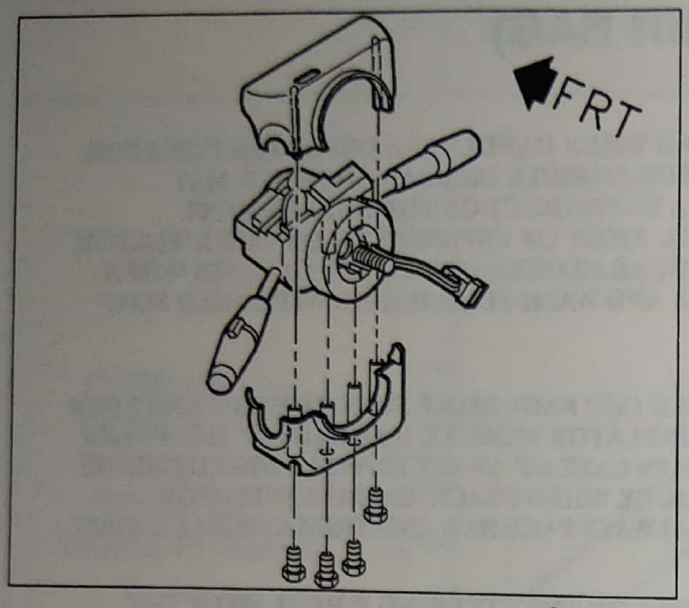

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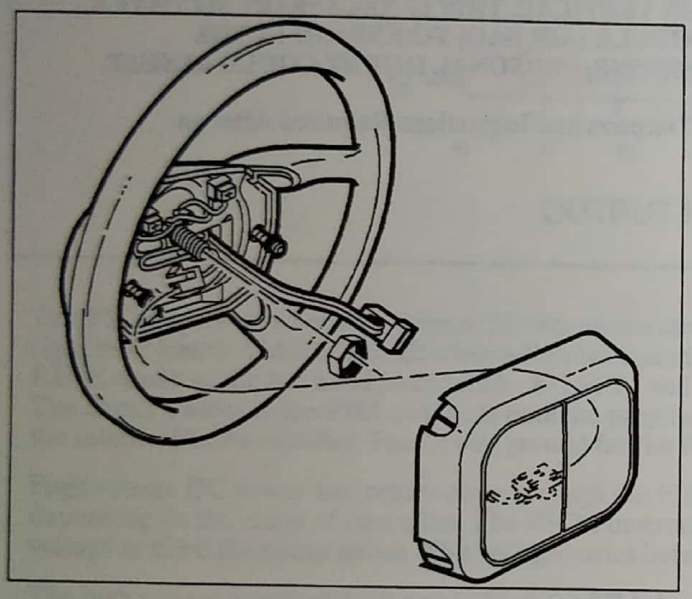

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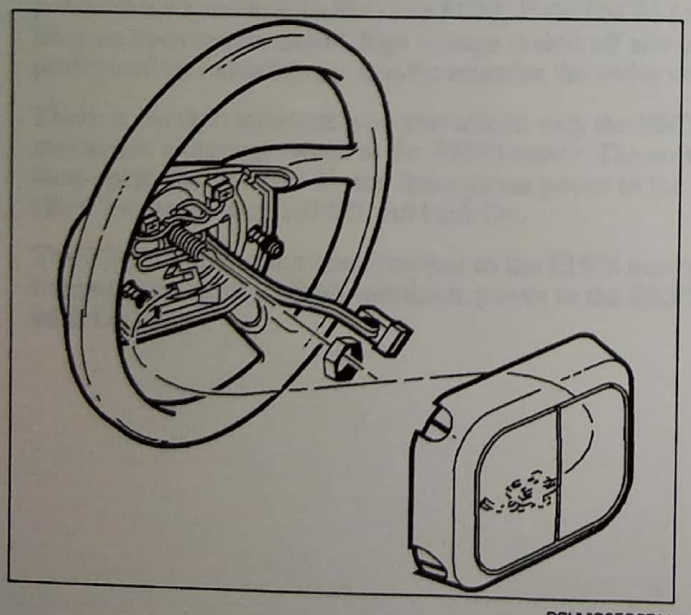


PSMVIS65863AA

DRIVERS SIDE SIR INFLATOR MODULE

REMOVAL

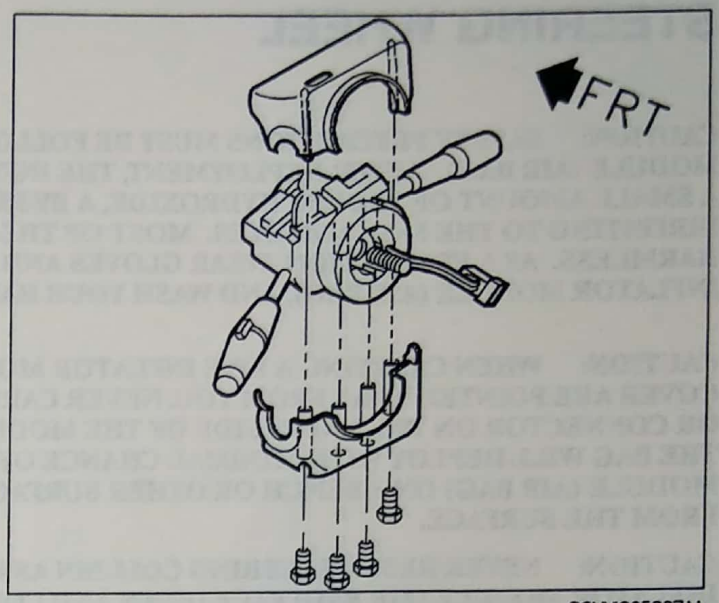
1. Disable the SIR system. (Refer to "Disabling the SIR System" in this manual.)
2. Remove outer screws from lower steering column trim cover and lift upper trim panel off.
3. Remove inner screws from lower steering column trim cover to remove lower trim cover.
4. Remove screws from back of steering wheel which retains the SIR inflator module.
5. Remove the connector position assurance (CPA) from inflator module connector and disconnect the connector. Remove SIR inflator module.

INSTALLATION

1. Route yellow SIR inflator module wire harness within the steering wheel hub forming an "S" shape with wire.
2. Connect SIR inflator module connector and install CPA.
3. Install SIR inflator module to steering wheel.

Torque: 10 N•m (89 in–lbs)

4. Align lower steering column trim cover to steering column and install inner screws.
5. Align upper steering column trim panel to steering column and install outer screws in lower steering column trim panel.
6. Enable the SIR system. (Refer to "Enabling the SIR system" in this manual.)



PSMIS65827AA

STEERING WHEEL

CAUTION: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG). AFTER DEPLOYMENT, THE INFLATOR MODULE (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE INFLATOR MODULE (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG), AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

CAUTION: WHEN CARRYING A LIVE INFLATOR MODULE (AIR BAG), MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY INFLATOR MODULE (AIR BAG) BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE INFLATOR MODULE (AIR BAG) ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

CAUTION: NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE INFLATOR MODULE (AIR BAG) FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE INFLATOR MODULE (AIR BAG) TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

IMPORTANT: In the event deployment has occurred, refer to "Repairs and Inspections Required After an Accident" in the "SIR Service Manual."

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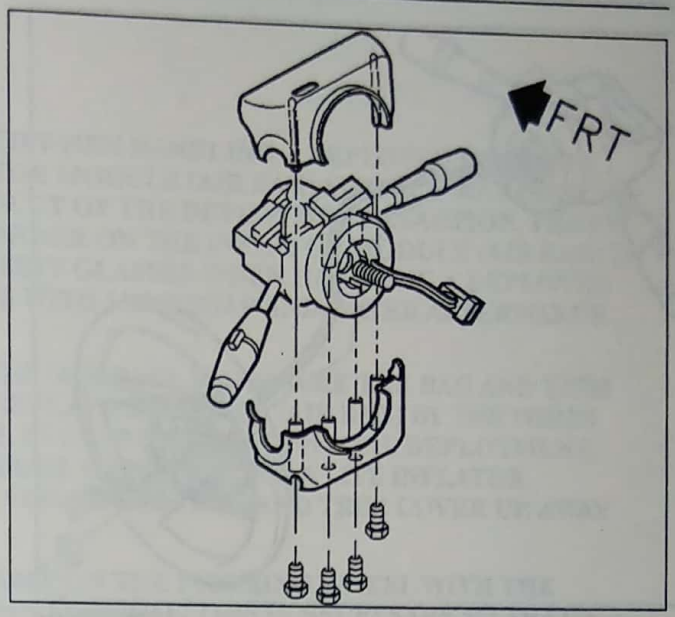
STEERING WHEEL

REMOVAL

1. Disable the SIR system. (Refer to "Disabling the SIR System" in this manual.)
2. Remove outer screws from lower steering column trim cover and lift upper trim panel off.
3. Remove inner screws from lower steering column trim cover to remove lower trim cover.



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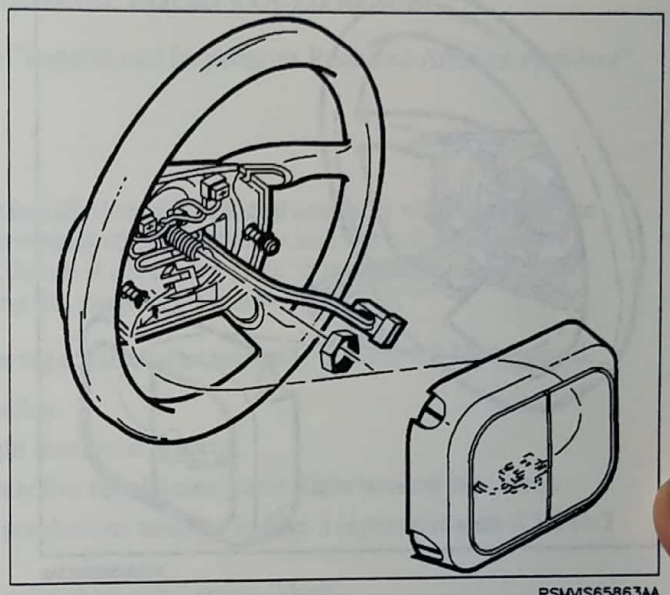
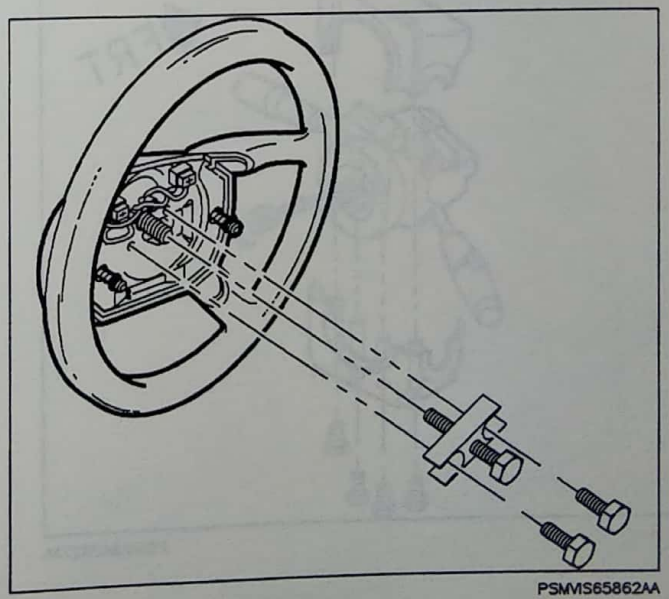
4. Remove screws from back of steering wheel that retains the SIR inflator module. Remove connector position assurance (CPA) from SIR inflator module connector and disconnect connector. Remove SIR inflator module.



PSMMS65863AA

5. Disconnect horn switch connector.
6. Remove nut from steering column that retains steering wheel.
7. Install steering wheel puller SA9218NE and remove steering wheel.



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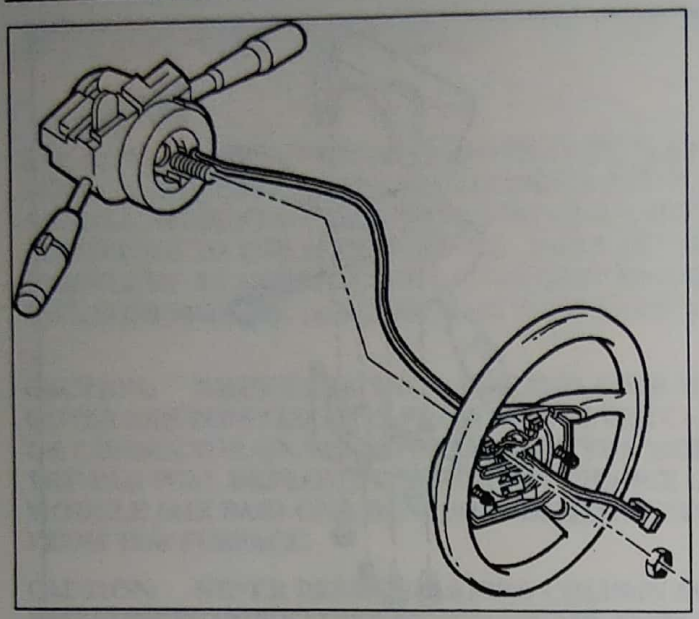
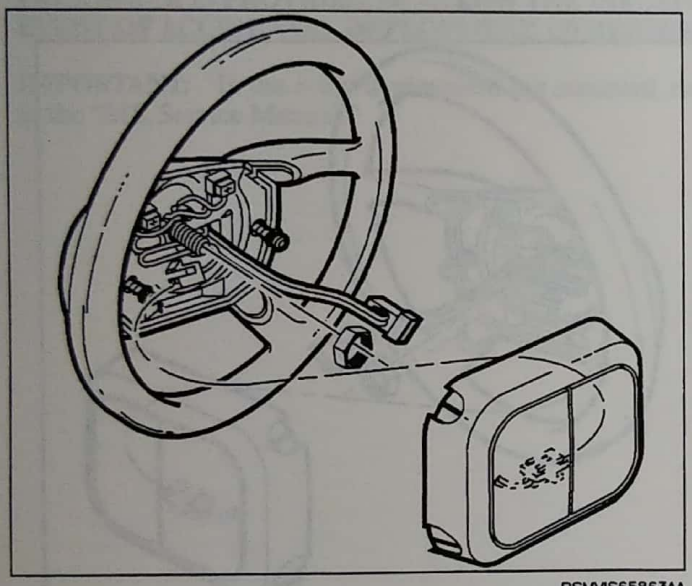


PSMWS65864AA

INSTALLATION

1. Route SIR cable through steering wheel. Install steering wheel to column. Connect horn wire connector.
2. Install steering wheel nut.

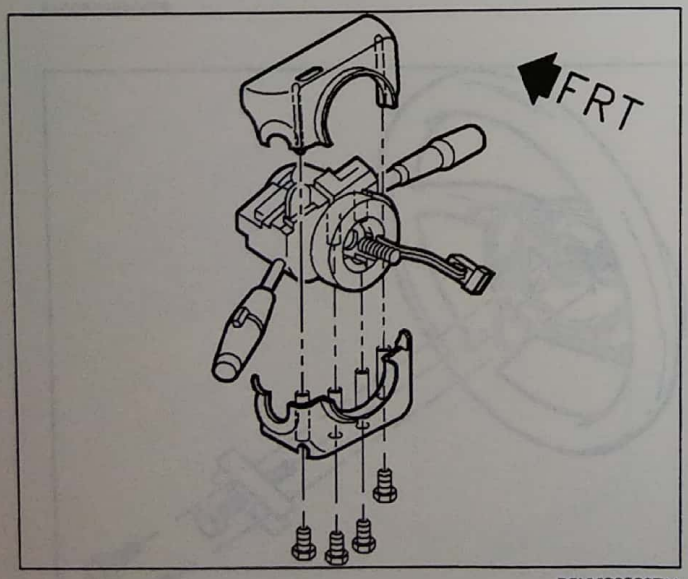
Torque: 42 N•m (31 ft−lbs)



PSMWS65863AA

3. Route yellow SIR inflator module wire harness within the steering wheel hub forming an "S" shape with wire.
4. Connect inflator module connector and install CPA.
5. Install SIR inflator module to steering wheel.

Torque: 10 N•m (7 ft−lbs)



PSMWS65827AA

6. Install lower steering column trim cover to steering column and install inner screws.
7. Install upper steering column trim panel to steering column and install outer screws in lower steering column trim panel.
8. Enable the SIR system. (Refer to "Enabling the SIR System" in this manual.)

SIR COIL ASSEMBLY

CAUTION: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG). AFTER DEPLOYMENT, THE INFLATOR MODULE (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE INFLATOR MODULE (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG), AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

CAUTION: WHEN CARRYING A LIVE INFLATOR MODULE (AIR BAG), MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY INFLATOR MODULE (AIR BAG) BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE INFLATOR MODULE (AIR BAG) ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

CAUTION: NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE INFLATOR MODULE (AIR BAG) FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE INFLATOR MODULE (AIR BAG) TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

IMPORTANT: In the event deployment has occurred, refer to "Repairs and Inspections Required After an Accident" in the "SIR Service Manual."

REPOSITIONING SIR COIL ASSEMBLY

IMPORTANT: If orange tab is inadvertently removed prior to installation, the SIR coil assembly will remain in the locked position until it is installed. The locking device will be depressed after installation and the coil assembly will rotate freely when the steering column is rotated. If the locking devise is depressed prior to installation and the coil assembly is rotated, the coil will need to be realigned by following the steps listed below.

IMPORTANT: If coil assembly is not properly oriented to steering column/gear assembly the coil will be damaged.

1. Depress the tab and spring assembly in the rear of coil assembly.
2. Gently rotate coil hub **clockwise** with tab removed until slight tension is present.
3. Gently rotate coil hub **counterclockwise** (count approximately five revolutions) until slight tension is present.
4. Gently rotate coil hub **clockwise** one half of the number of revolutions counted in step 2 (approximately 2 1/2 to 3 turns).
5. Rotate smallest distance required to align the inner arrow (yellow) to outer arrow (black).

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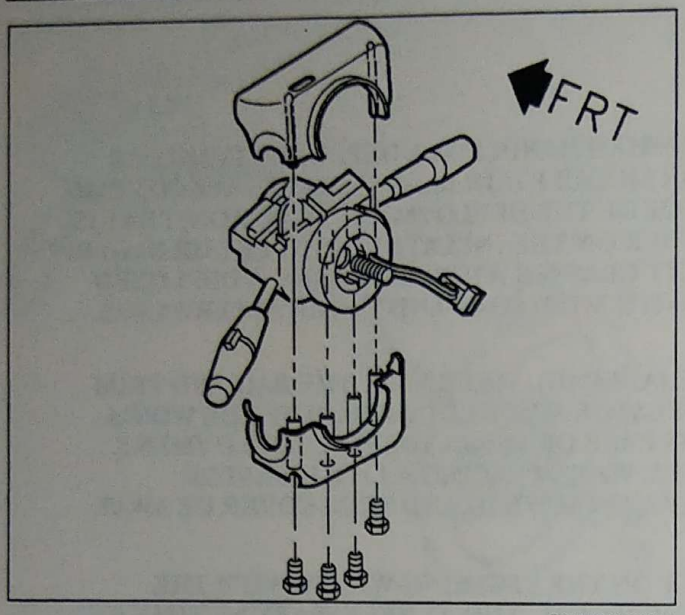
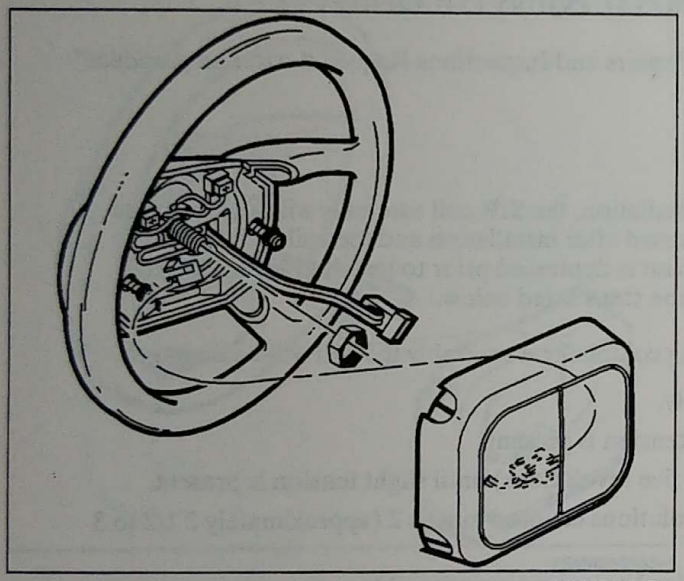
SIR ROLL COIL REMOVAL



PSMVIS65827AA

REMOVAL

1. Disable the SIR system. (Refer to "Disabling the SIR System" in this service manual.)
2. Remove outer screws from lower steering column trim cover and lift upper trim panel off.
3. Remove inner screws from lower steering column trim cover to remove lower trim cover.



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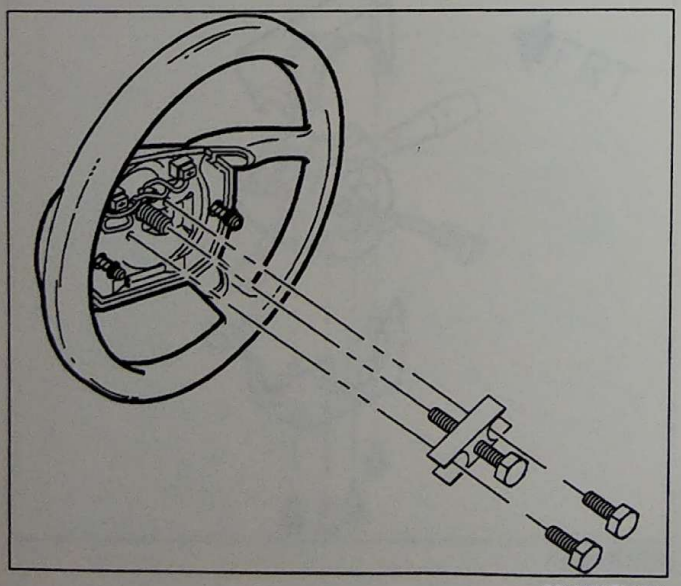
4. Remove screws from back of steering wheel that retains SIR inflator module. Remove connector position assurance (CPA) from SIR inflator module connector and disconnect the connector. Remove SIR inflator module.



PSMVIS65862AA

5. Disconnect horn switch connector.
6. Remove nut from steering column which retains the steering wheel.
7. Install steering wheel puller SA9218NE and remove steering wheel.

CAUTION: ALWAYS ALIGN THE FRONT WHEELS TO THE STRAIGHT AHEAD POSITION WHEN INSTALLING OR REMOVING AN SIR COIL ASSEMBLY. IF AN SIR COIL ASSEMBLY IS REMOVED WITHOUT THE WHEELS IN THE STRAIGHT AHEAD POSITION AND THE STEERING WHEEL HAS NOT BEEN MOVED, THE SAME SIR ASSEMBLY COIL CAN BE REINSTALLED IF THE COIL HUB HAS NOT BEEN ROTATED.

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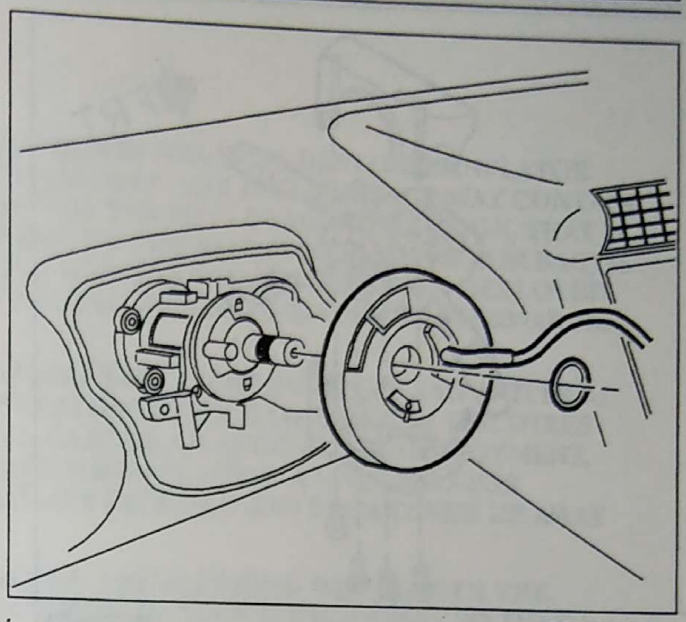
8. Remove snap ring from steering column shaft and disconnect SIR roll coil at base of column.
9. Slide SIR cable tie wrap down steering column shaft from underneath the instrument panel.
10. Cut tie wrap and remove SIR roll coil with wire.

INSTALLATION

IMPORTANT: A new SIR coil assembly is equipped with a orange tab that is removed after the steering wheel is installed. This tab passes through the steering wheel at the pass through hole.

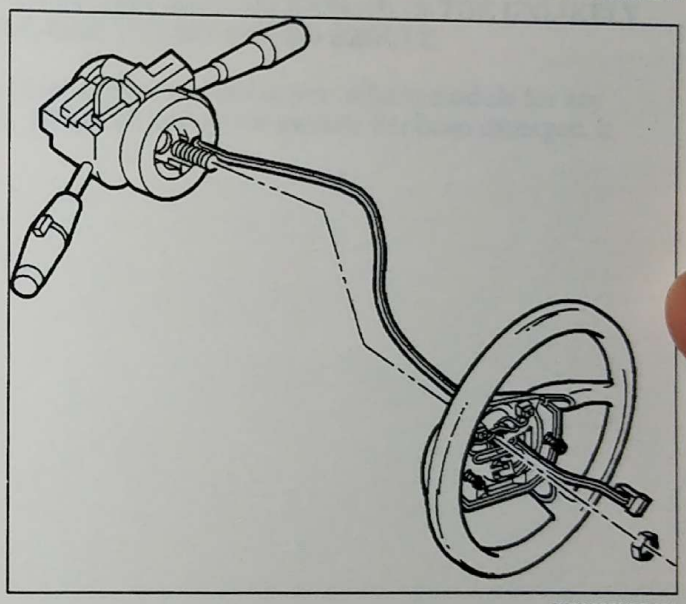
1. Route SIR coil harness down steering column.
2. Install SIR roll coil to steering column and install snap ring. Verify snap ring is seated on steering column.



PSMIS66345AA

3. Route SIR wire through steering wheel. Install steering wheel to column. Connect horn wire connector.
4. Install steering wheel nut.

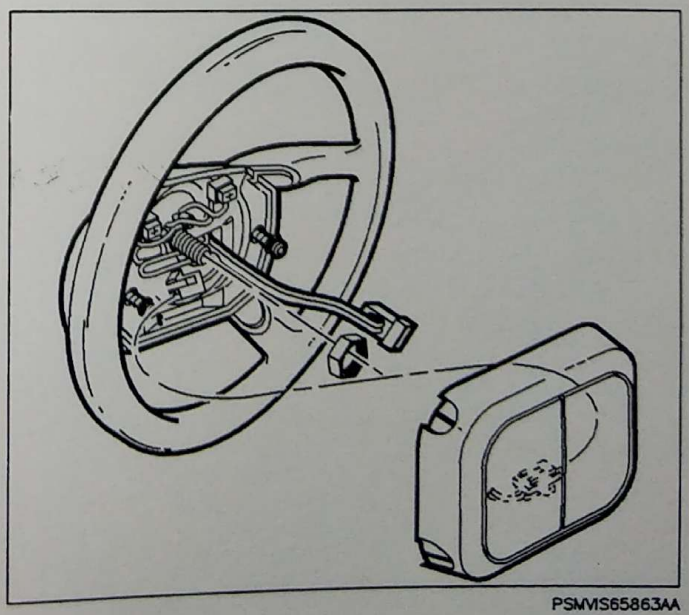
Torque: 42 N•m (31 ft–lbs)



PSMIS65864AA

5. Route yellow inflator module wire harness within the steering wheel hub forming an "S" shape with wire.
6. Connect inflator module connector and install CPA.
7. Install inflator module to steering wheel.

Torque: 10 N•m (89 in–lbs)



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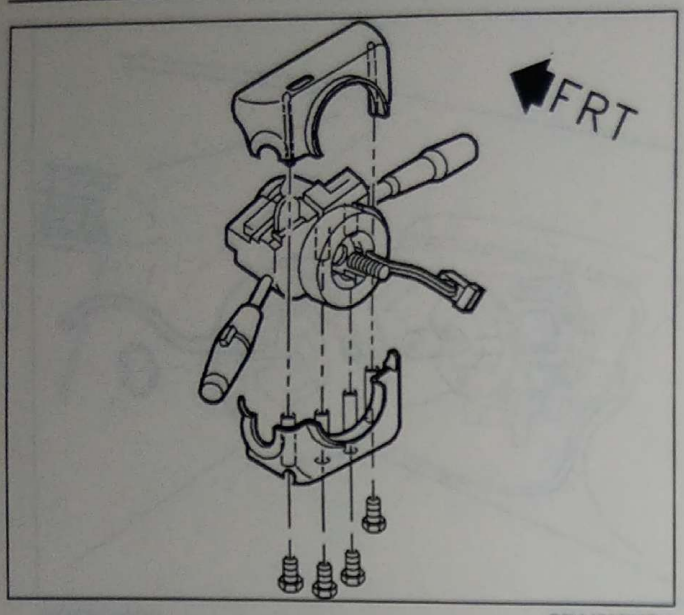

PSMMS65827AA

8. Align lower steering column trim cover to steering column and install inner screws.
9. Align upper steering column trim panel to steering column and install outer screws in lower steering column trim panel.

STEERING COLUMN

CAUTION: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG). AFTER DEPLOYMENT, THE INFLATOR MODULE (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE INFLATOR MODULE (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED INFLATOR MODULE (AIR BAG), AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

CAUTION: WHEN CARRYING A LIVE INFLATOR MODULE (AIR BAG), MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY INFLATOR MODULE (AIR BAG) BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE INFLATOR MODULE (AIR BAG) ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

CAUTION: NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE INFLATOR MODULE (AIR BAG) FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE INFLATOR MODULE (AIR BAG) TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

IMPORTANT: In the event deployment has occurred, inspect coil assembly wire and driver inflator module for any signs of scorching, melting or other damage due to excessive heat. If the coil or inflator module has been damaged, it must be replaced.

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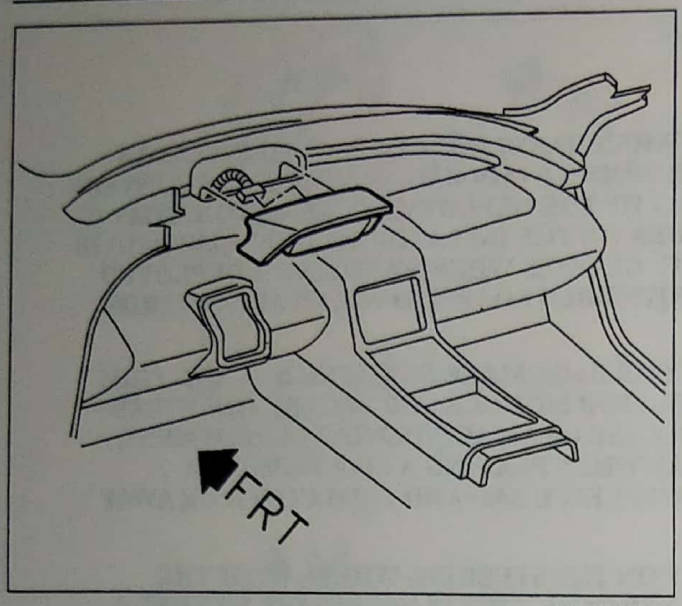
STEERING COLUMN

REMOVAL

1. Disable the SIR system. (Refer to "Disabling the SIR System" in this manual.)
2. Remove instrument panel cluster (IPC) by lifting upward and rearward, disconnect the IPC connector.



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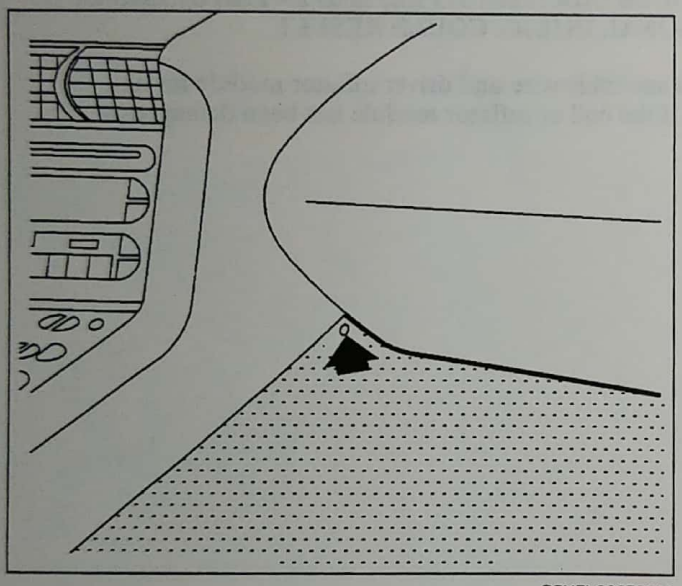
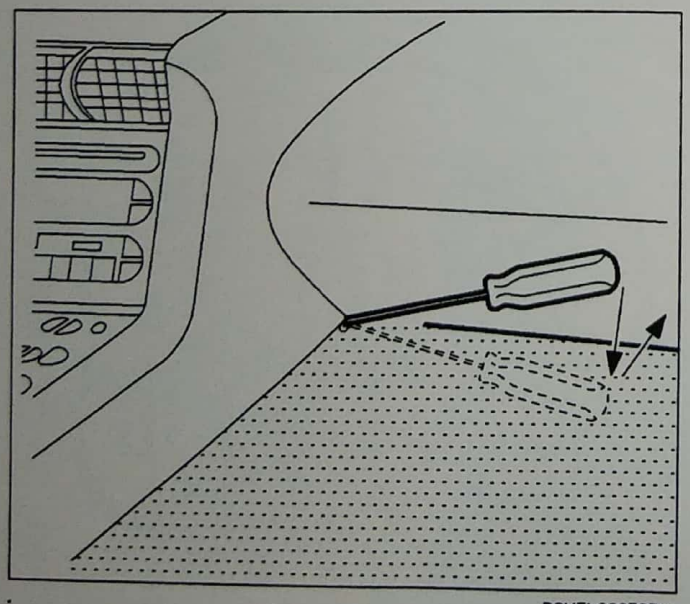


PSMELC66382AA

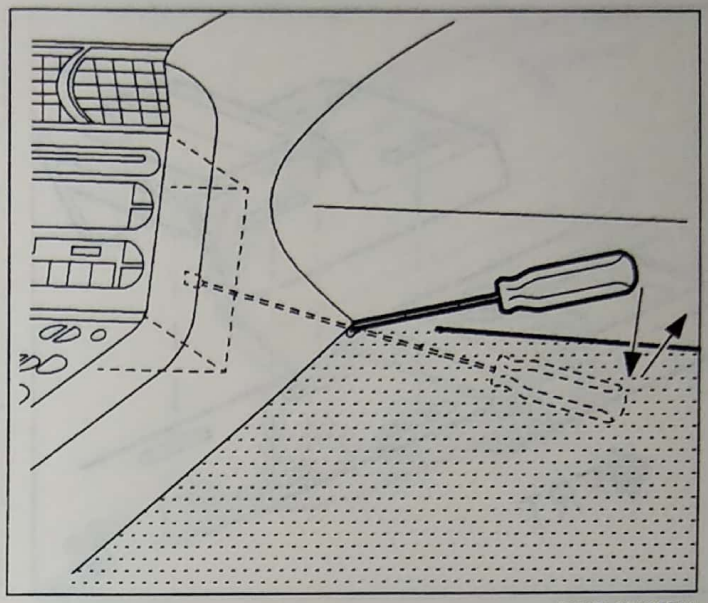
3. Locate hole in instrument panel tunnel bracket on right side behind carpet.
4. Use a knife to make a small slit in carpet over the hole.



PSMELC66383AA

5. Insert a screwdriver with a blade about 152−304 mm (6 in.−12 in.) long into the hole in the instrument panel tunnel bracket. Slide screwdriver along instrument panel radio bracket until the screwdriver is wedged between bracket and the radio lock tab. The screwdriver should be inserted about 152mm (6 in.).

6. Push downward then forward on the screwdriver handle, lifting the lock tab upward and the radio rearward simultaneously. The radio should move rearward enough so that it can be pulled out the rest of the way by hand.
7. With the brake applied, shift run/lock shift assembly (RSA) to DRIVE, then select ACCY mode to shut Off power and apply the parking brake to keep the vehicle from rolling unexpectedly.
8. Lay a clean shop rag over the RSA to help protect it from getting scratched by the radio case during radio removal.
9. Slide radio out of instrument panel.



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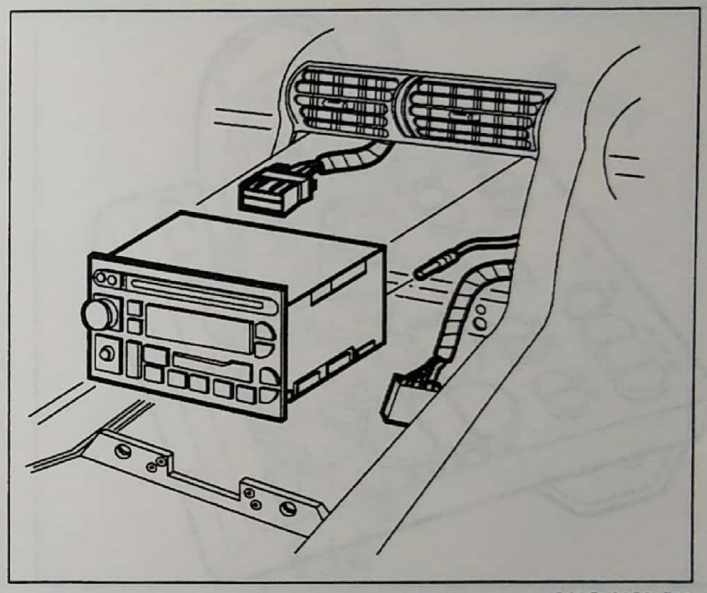
10. Disconnect the antenna lead first, then the harness connector.
11. With the brake applied, select the RUN mode again, and shift back to PARK. Then select the lock mode to turn the vehicle Off.



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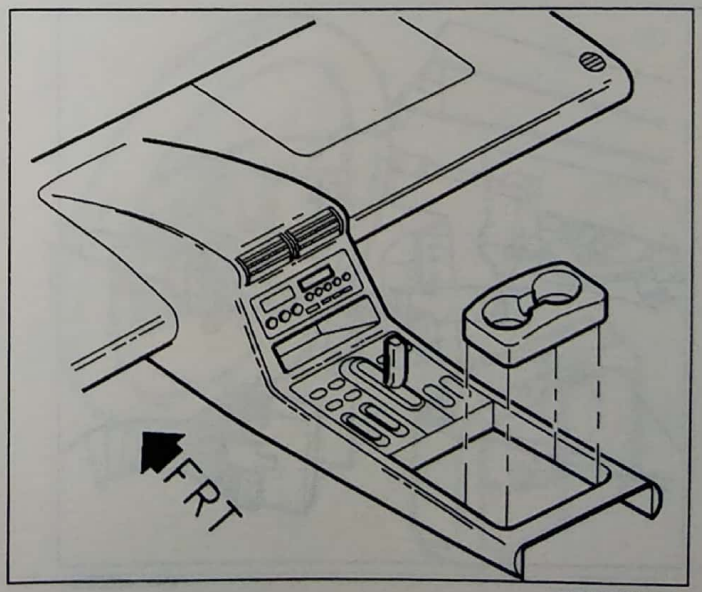
12. Remove cup holder.



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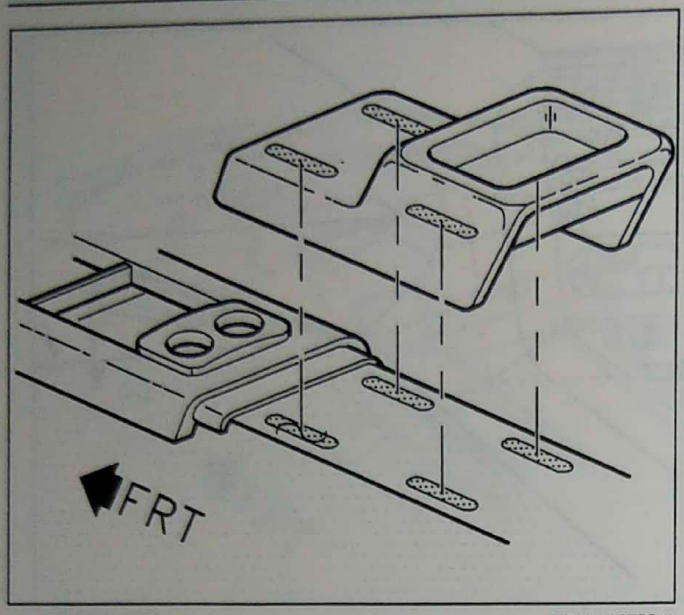

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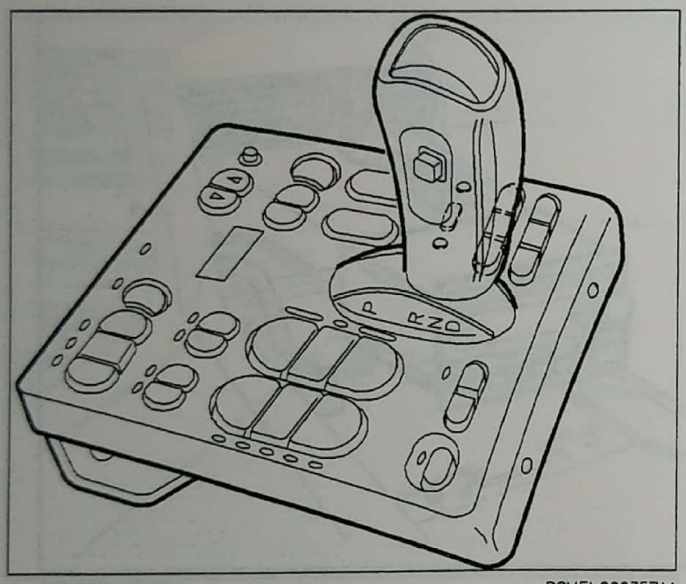
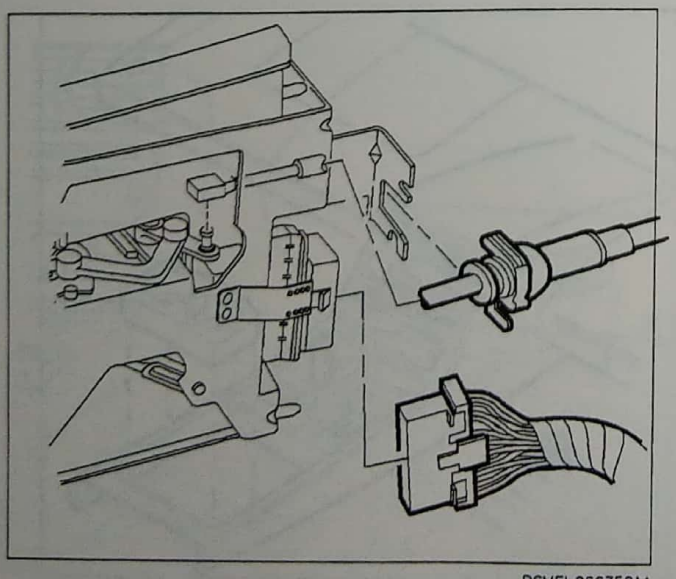
13. Remove arm rest from tunnel by lifting upward releasing Dual-Lock retainers.



PSMELC66357AA

14. Remove the T–25 TORX™ screws in the rear of the RSA, pull RSA rearward about 63 mm (2.5 in.).

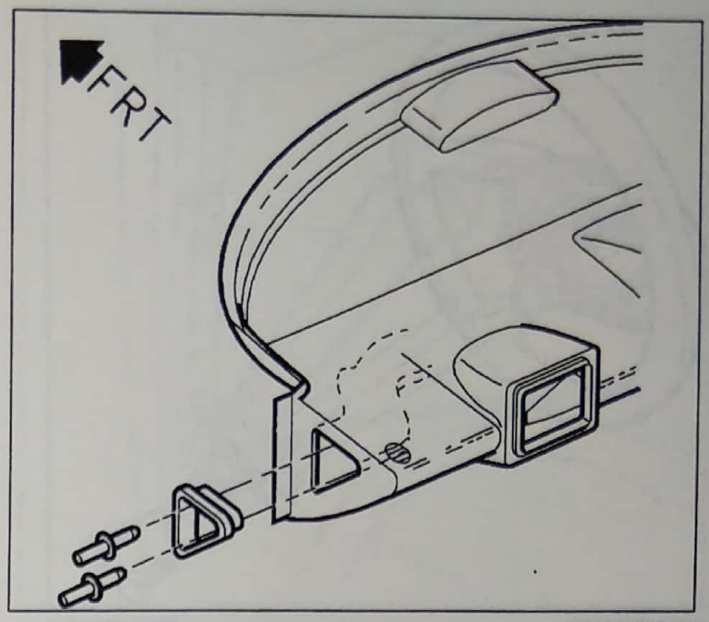


PSMELC66358AA

15. Rotate RSA towards the drivers side of the vehicle to a 45 degree angle.
16. Disconnect the RSA wire harness connector.
17. Disconnect the shift cable from the shifter and remove shift cable from retainer bracket by prying locking tab on drivers side of RSA gently and pushing cable down out of bracket.

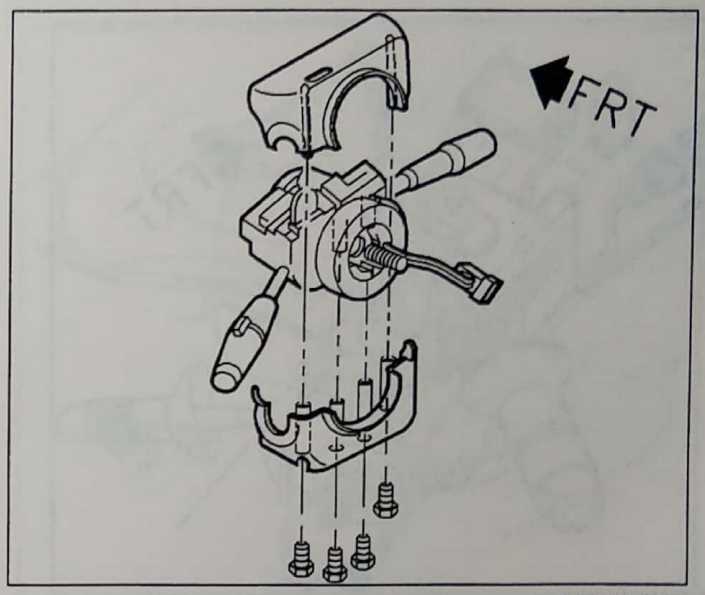
CamScanner

18. Drill out rivets from side door air outlets.
19. Remove left and right front side door air outlets on the side of instrument panel with doors open.



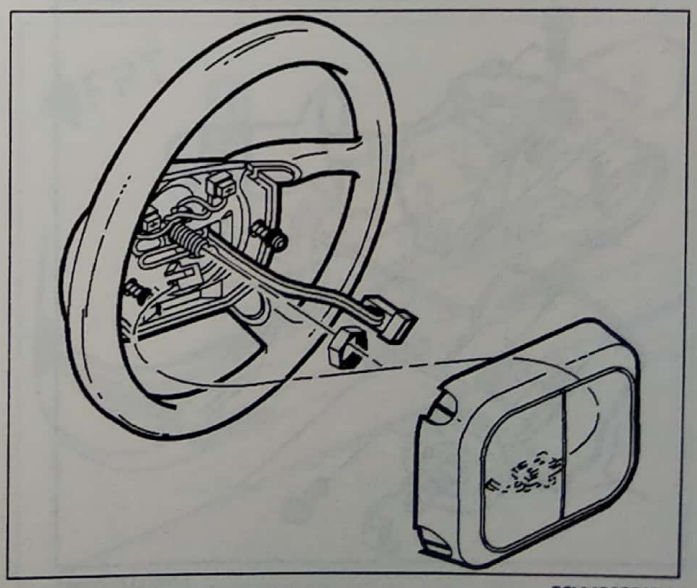
PSMMS65736AA

20. Remove outer screws from lower steering column trim cover, lift upper trim panel off.
21. Remove inner screws from lower steering column trim cover and remove lower trim cover.



PSMMS65827AA

22. Remove screws from back of steering wheel that retains SIR inflator module.
23. Remove connector position assurance (CPA) and disconnect inflator module connector.
24. Remove SIR inflator module.



PSMMS65863AA

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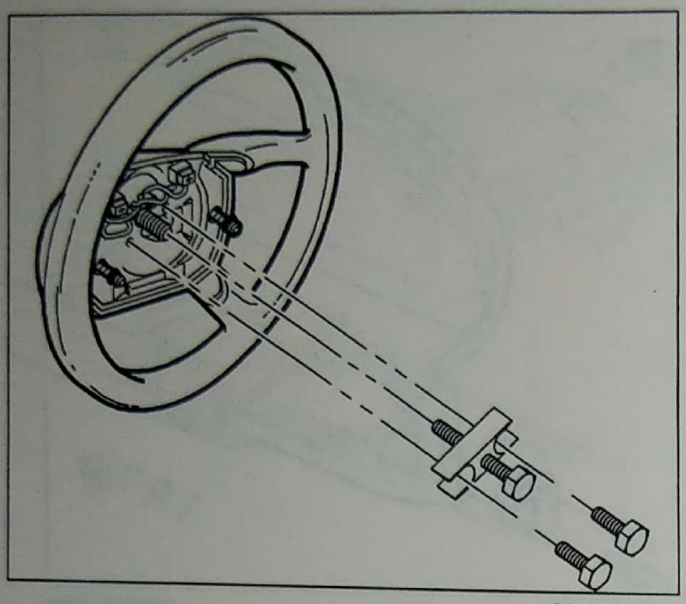
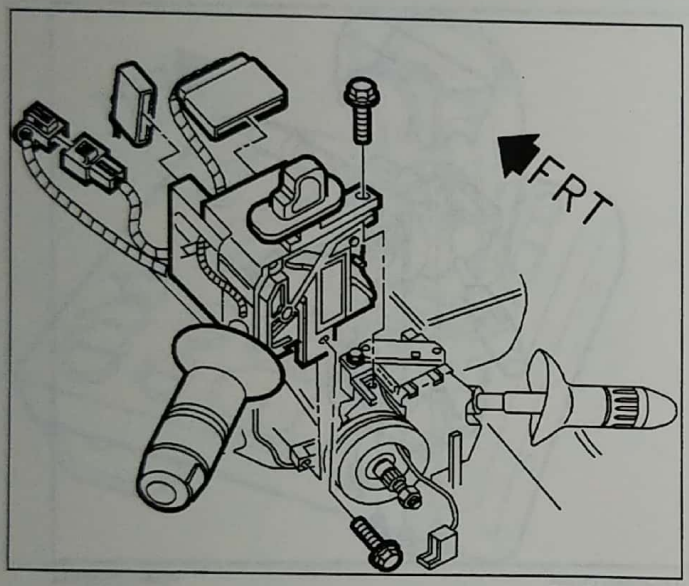


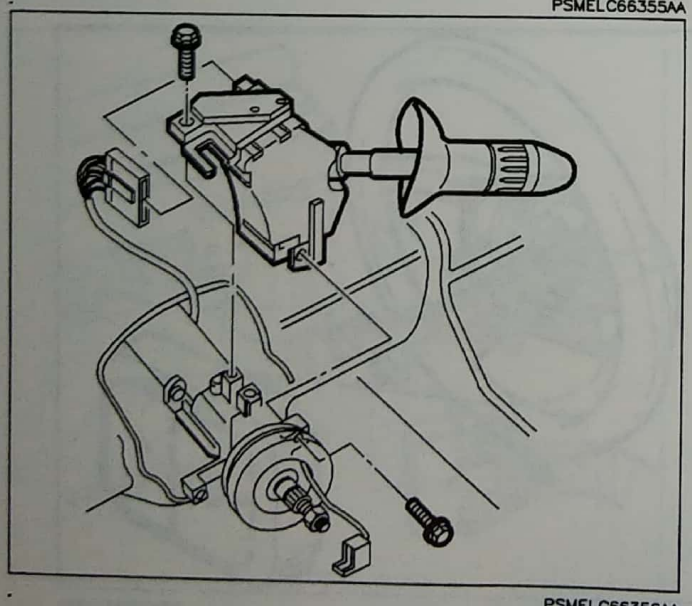
PSMVIS65862AA

25. Disconnect horn switch connector.
26. Remove nut from steering column that retains steering wheel.
27. Install steering wheel puller SA9218NE and remove steering wheel.



PSMELC66355AA

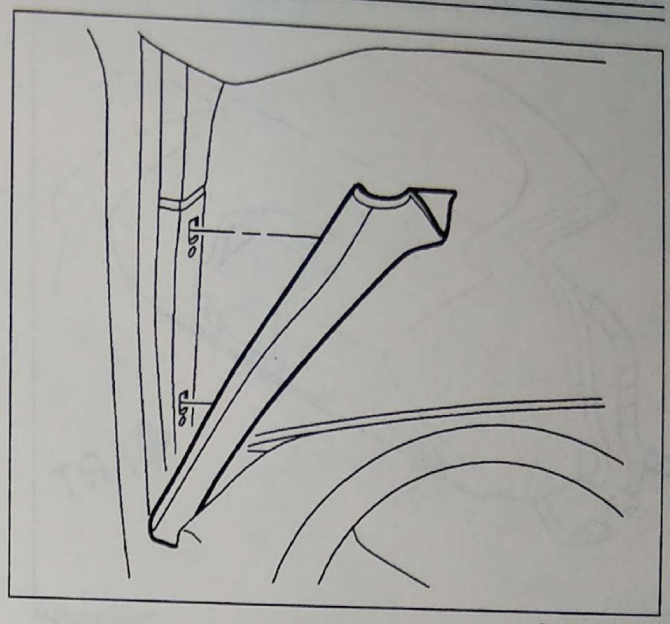
28. Remove T–25 TORX™ /7mm screws from turn signal, headlamp, and cruise switch.
29. Remove switch and disconnect switch connectors.



PSMELC66356AA

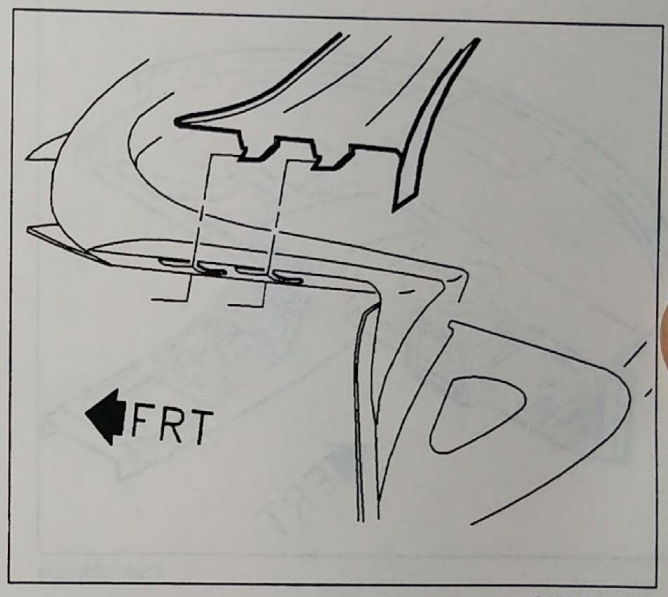
30. Remove T–25 TORX™ /7mm screws from windshield washer switch.
31. Disconnect connector and remove switch.

32. Starting at top of garnish molding, pull firmly at clip locations to disengage. Tipping the top of molding inward with the bottom engaged to instrument.



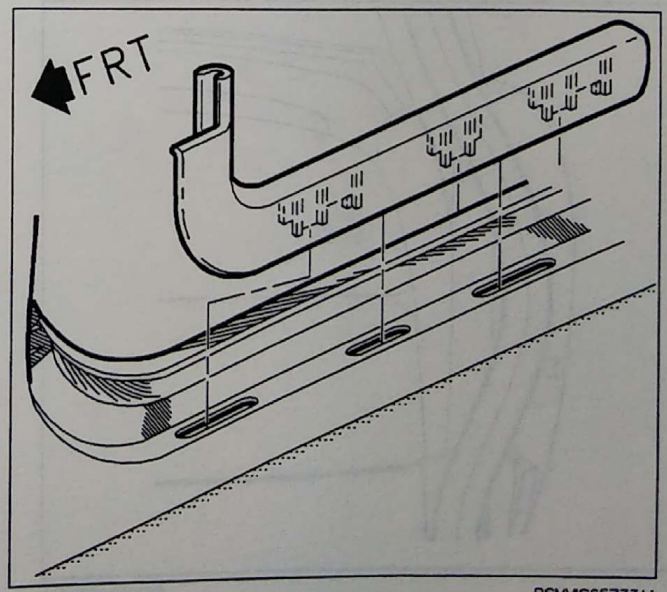
PSMWS66447AB

33. Disengage tabs on garnish molding from instrument panel by pulling rearward and inboard.



PSMWS66448AA

34. Starting at rear of carpet retainer, pull firmly on carpet retainer at clip locations to disengage clips.
35. Remove front side door opening floor carpet retainer.



PSMWS65733AA

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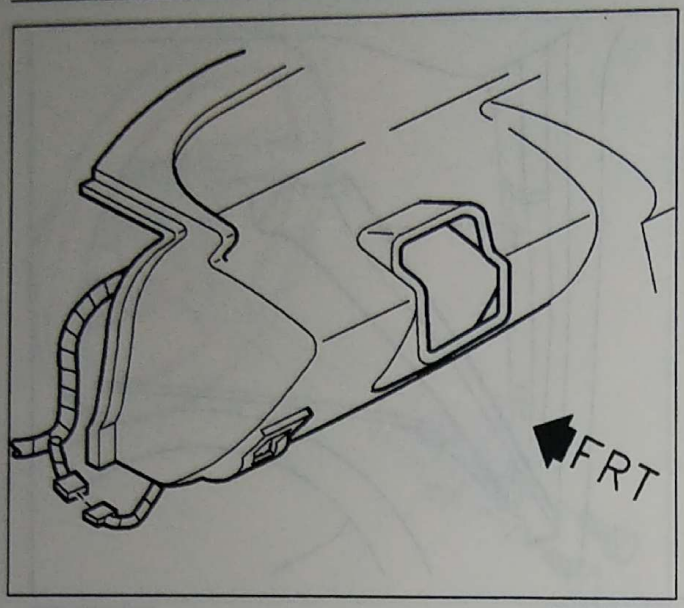
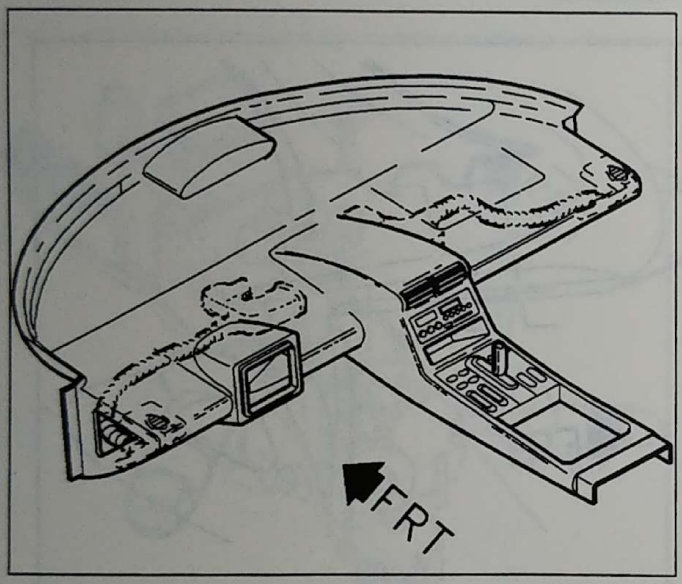


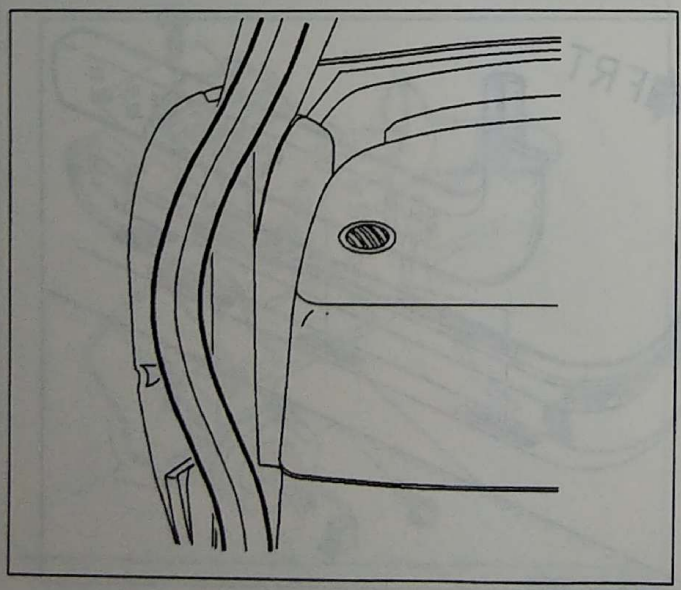
PSMMS65865AA

36. Disconnect parking brake switch connector.



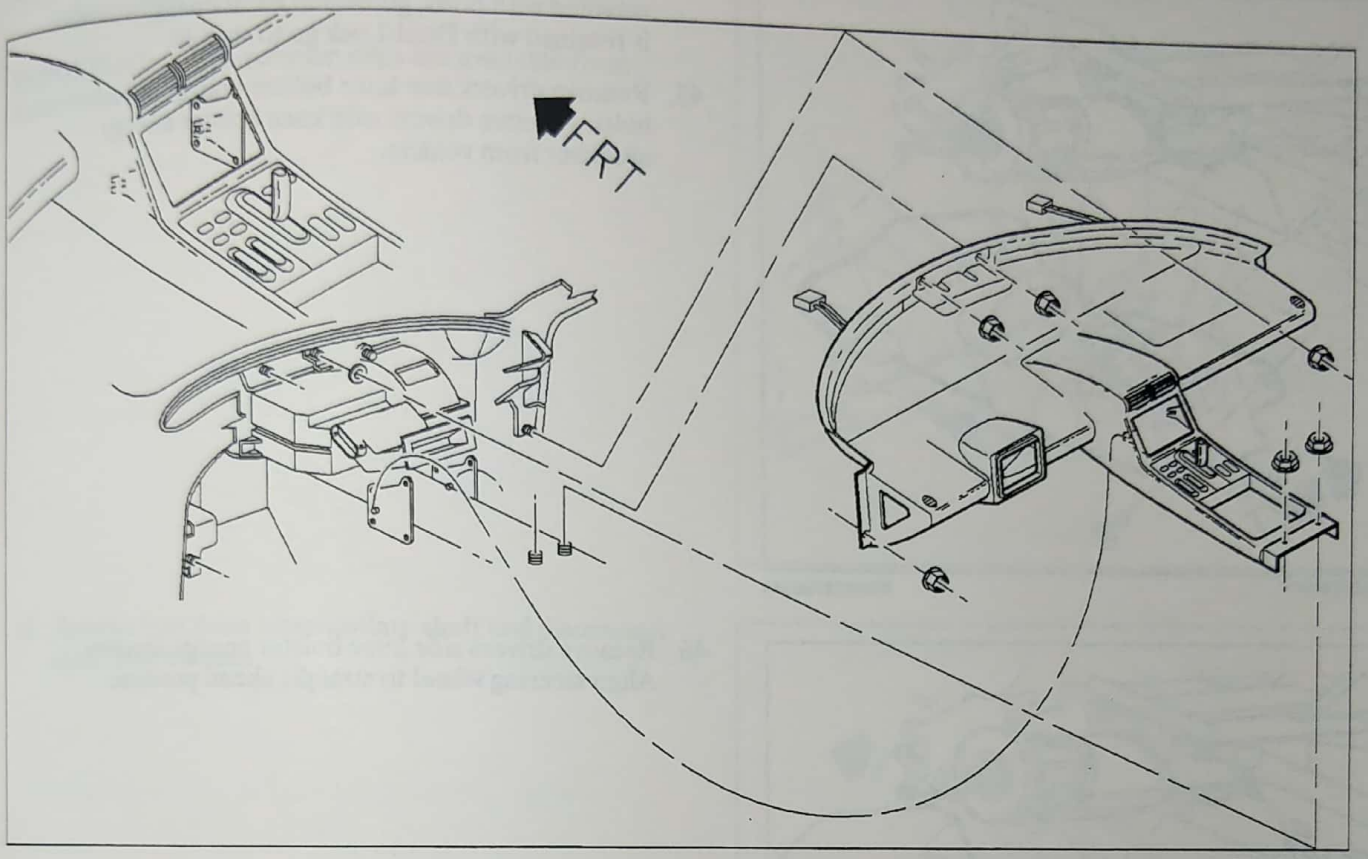
PSMMS66047AA

37. Disconnect side window demistor tubes from floor outlets.



PSMMS66337AA

38. Remove side door weatherstrip from pinch weld flange near instrument panel.



PSMVIS66048AA

39. Remove retainers from instrument panel.
40. Pull instrument panel rearward with slight upward pressure.
41. Pull driver's side demister tube through hole in steering column support
42. Disconnect both information telltale connectors.
43. Remove instrument panel from vehicle.

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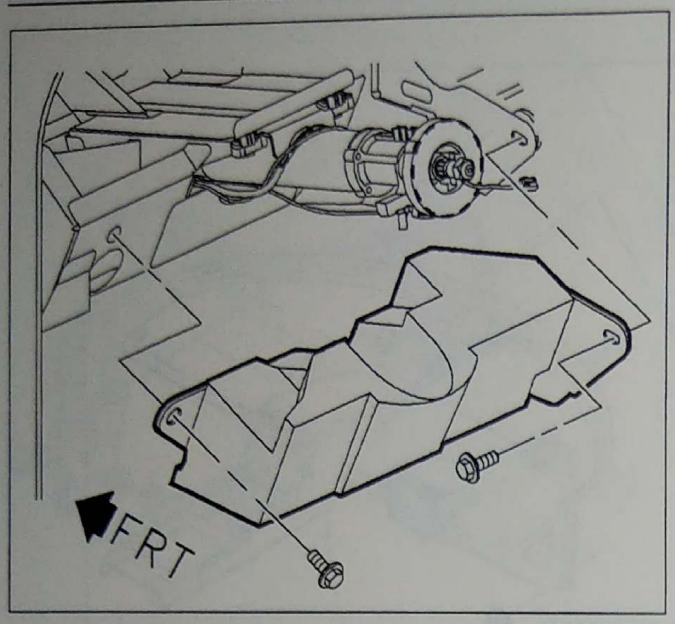
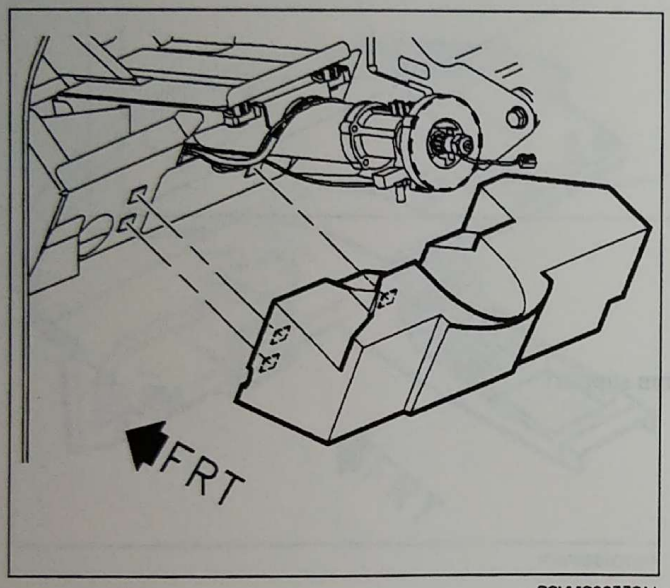


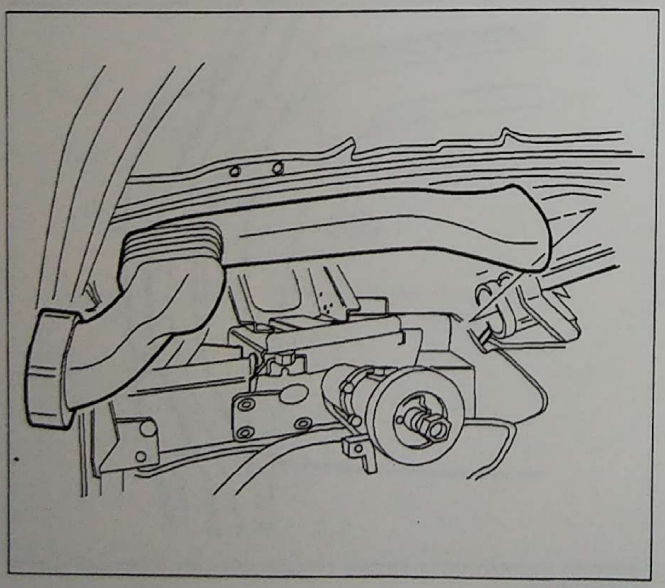
PSMVIS67898AA

44. If Driver side knee bolster energy absorber is retained with bolts, go to step 45. If energy absorber is retained with Dual-Lock go to step 46.
45. Remove drivers side knee bolster energy absorber bolts. Remove drivers side knee bolster energy absorber from vehicle.



PSMVIS66338AA

46. Remove drivers side knee bolster energy absober. Align steering wheel to straight ahead position



PSMVIS66336AA

47. Remove drivers side outer air duct.

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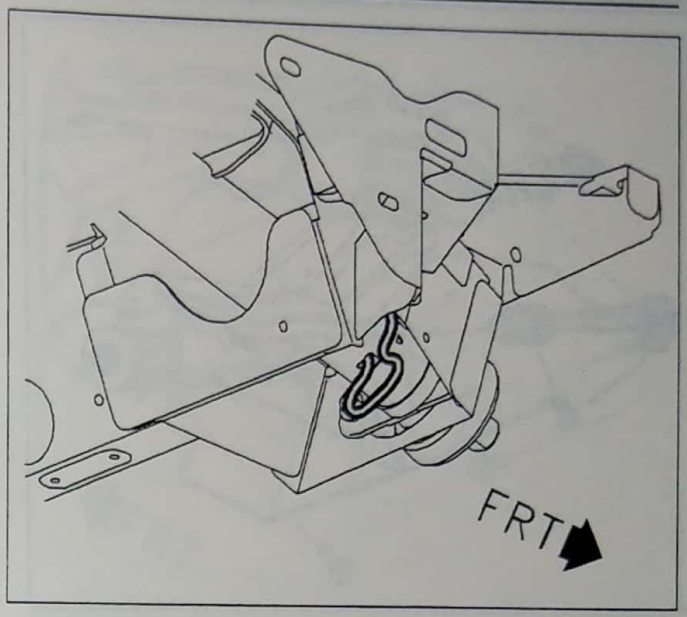
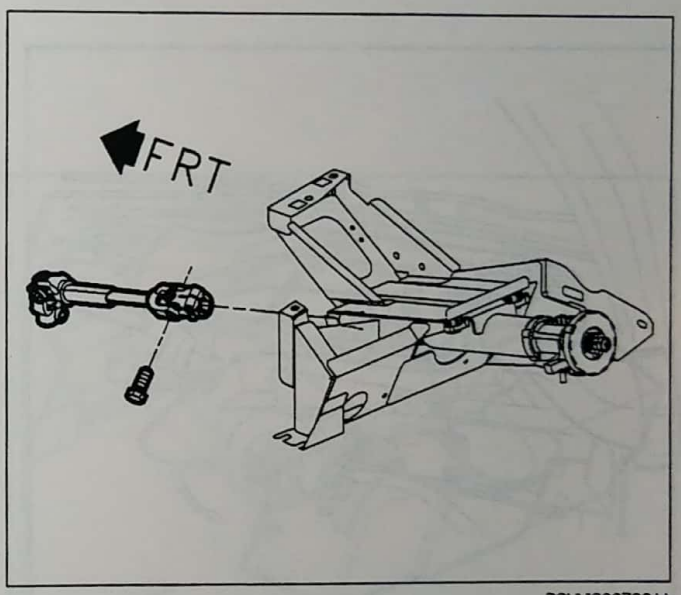
48. Install steering column anti-rotation clip in to base of column shaft.

IMPORTANT: Anti-rotation clips are available from Saturn Service Parts.



PSMIS66762AA

49. Remove bolt from intermediate shaft and disconnect shaft from column.



PSMIS66790AA

50. Remove bolts and nuts that retain steering column to steering column support. Remove steering column from vehicle.

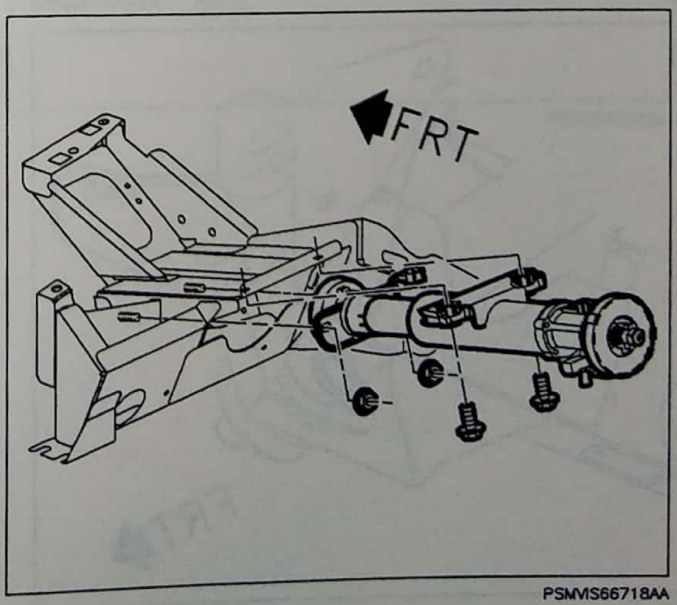
INSTALLATION

1. Load steering column into steering column support aligning studs on support to base of steering column.
2. Start bolts at upper mount of steering column and hand tighten.
3. Install nuts at base of steering column.

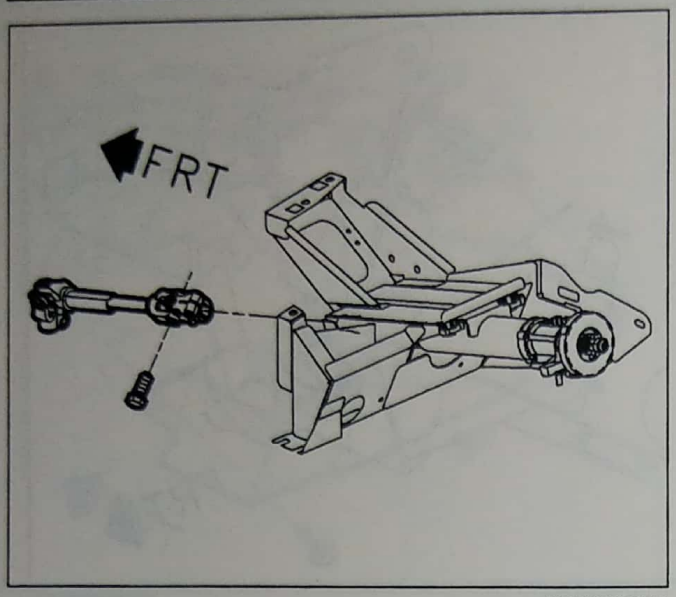
Torque: 25 N•m (19 ft–lbs)

4. Tighten bolts at upper mount of steering column.

Torque: 25 N•m (19 ft–lbs)



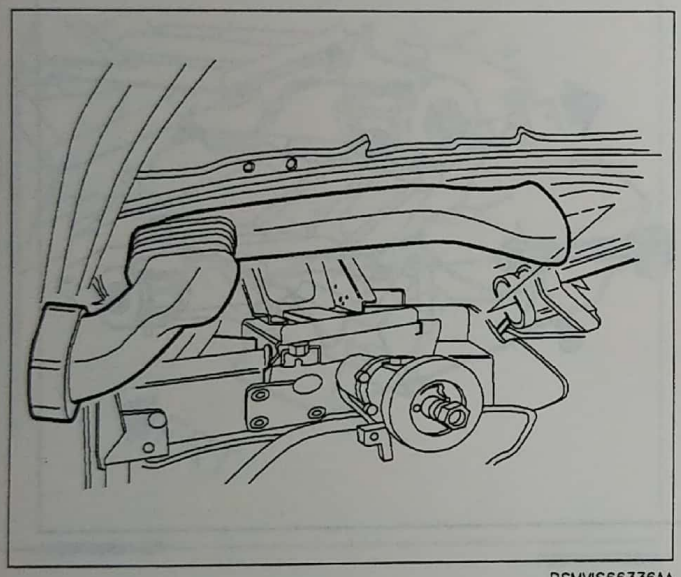
PSMIS66718AA



PSMVIS66790AA

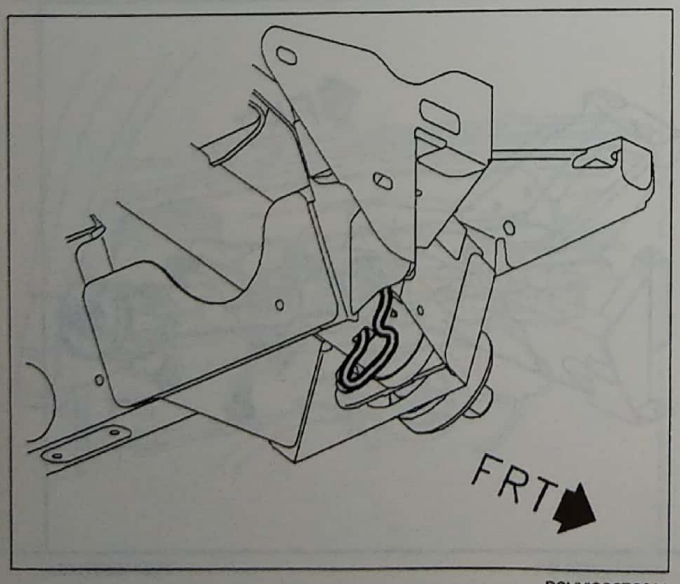
5. Fit intermediate shaft to splined end of steering column and install bolt to intermediate shaft.

Torque: 47 N•m (35 ft−lbs)



PSMVIS66336AA

6. Install driver side outer air duct.



PSMVIS66762AA

7. Remove anti-rotation clip from base of steering column.

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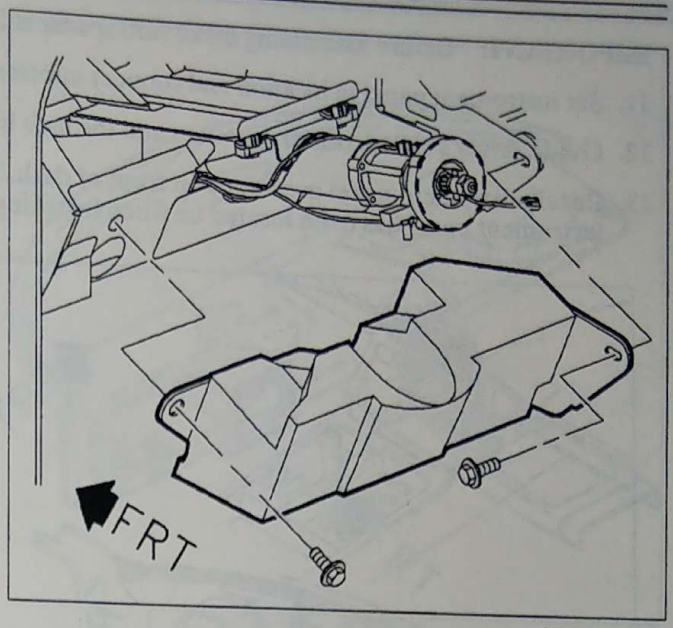
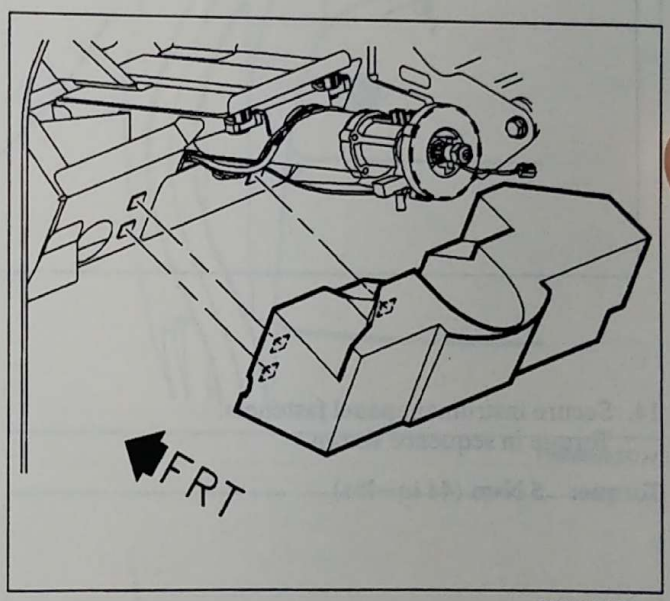
8. If drivers side knee bolster energy absorber is retained with bolts, go to step 9. If energy absorber is retained with Dual-Lock, go to step 10.
9. Align driver side knee bolster energy absorber and install bolts.

Torque: 25 N•m (19 ft−lbs)



PSMVIS67898AA

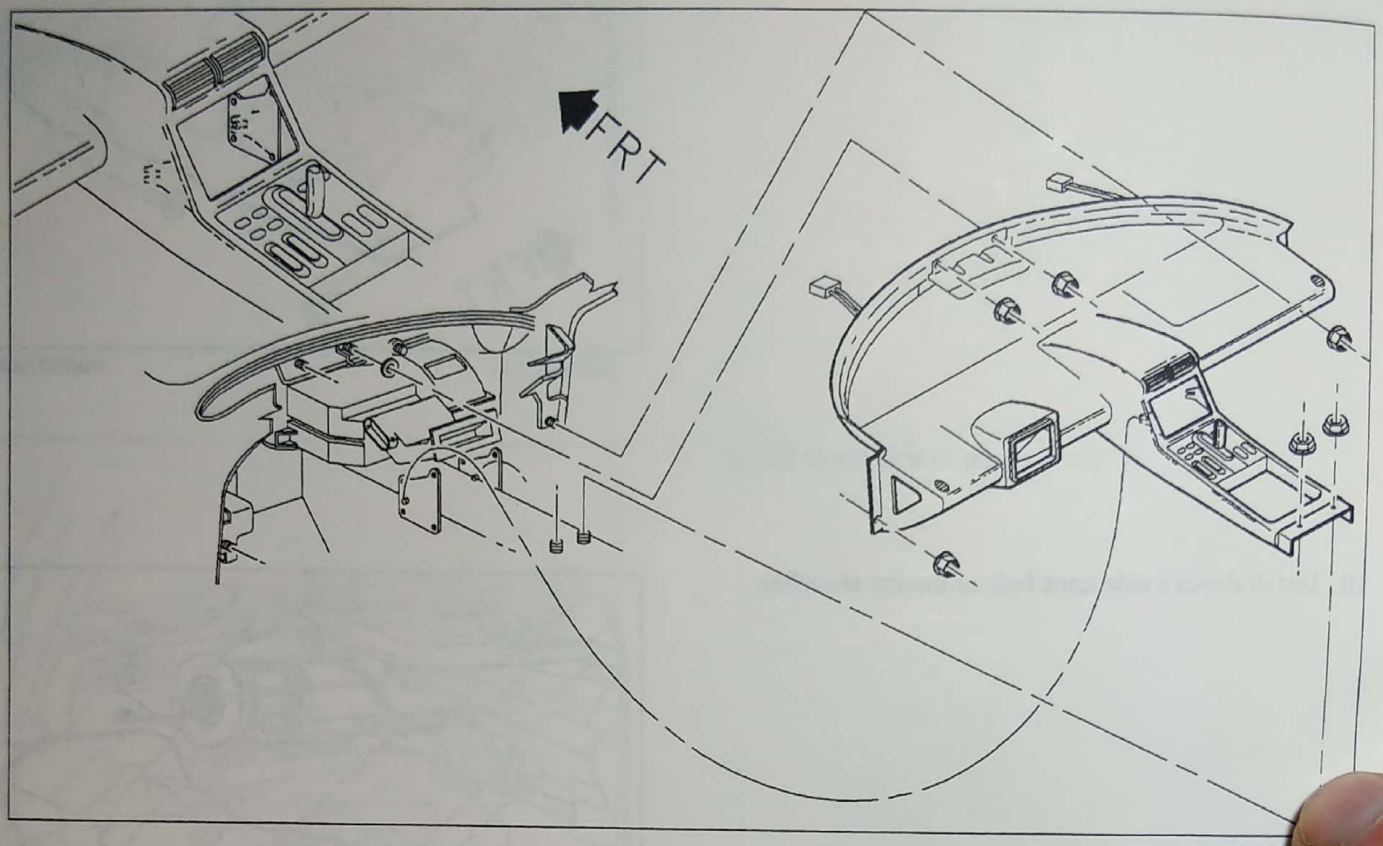
10. Install driver's side knee bolster energy absorber.



PSMVIS66338AA

IMPORTANT: Before assembling make sure spacer is in proper location to body. Refer to illustration.

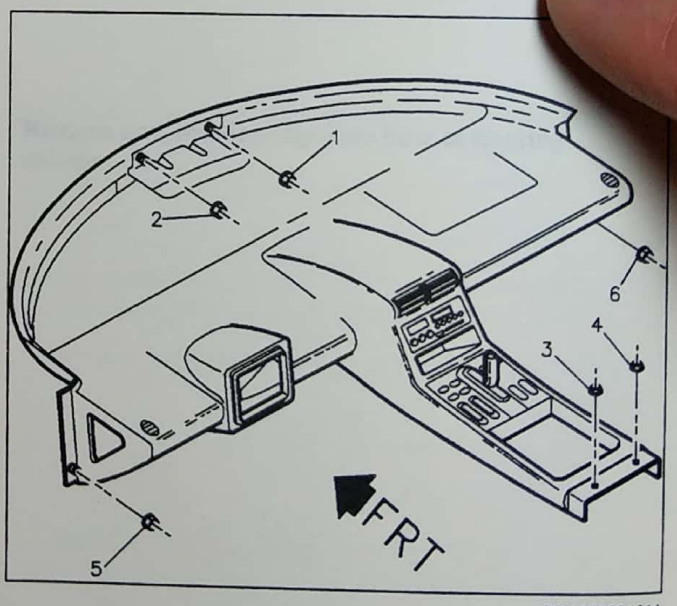
11. Set instrument panel in location and connect information telltale connectors.
12. Guide driver's side demister tube into and through hole in steering column support.
13. Install instrument panel over studs on front of dash. The tunnel has locator pins on either side of which the instrument panel has to be located on when installing.



PSMVIS

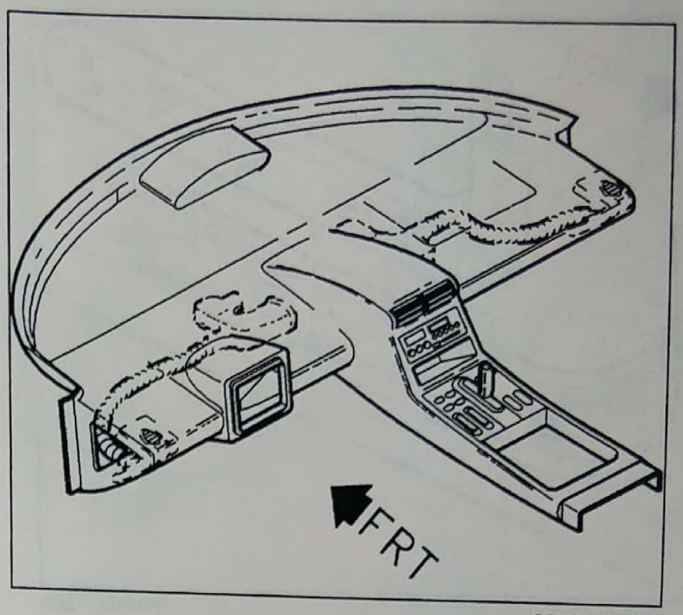
14. Secure instrument panel fasteners. Torque in sequence shown.

Torque: 5 N•m (44 in−lbs)



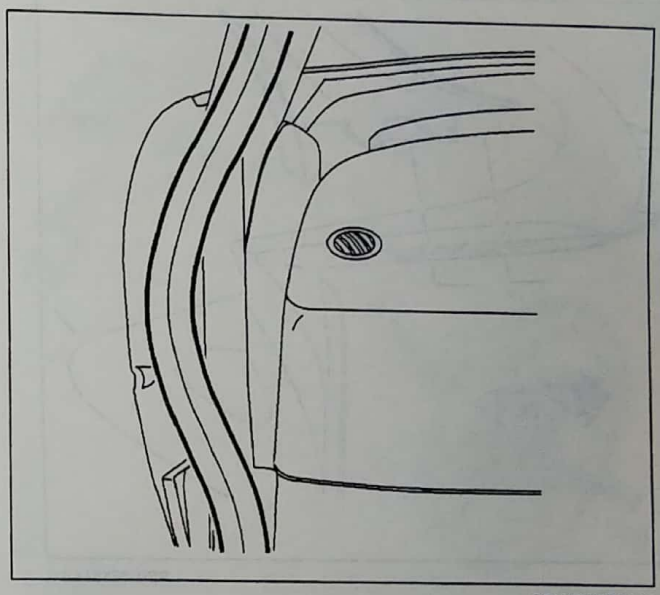
PSMVIS66049AA

15. Connect side window demister tubes to floor outlets.



PSMVIS66047AA

16. Install side door weatherstrip onto pinch weld flange near instrument panel.



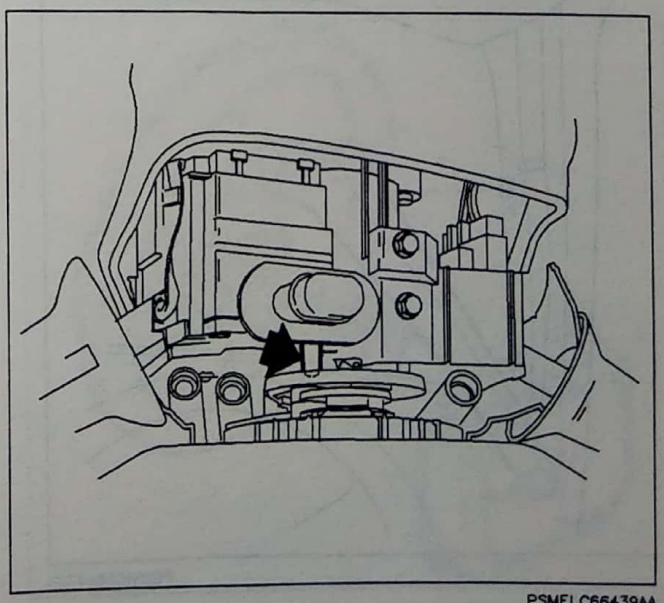
PSMVIS66337AA

17. Connect connector to windshield washer switch.
18. Install screws retaining switch.

Torque: 2.5 N•m (22 in−lbs)

19. Connect connectors to turn signal, headlamp, and cruise switch.
20. Place switch in position, being careful that the pin is positioned correctly against the ring on the back of the turn signal cancel cam assembly.
21. Install screws retaining switch.

Torque: 2.5 N•m (22 in−lbs)



PSMELC66439AA

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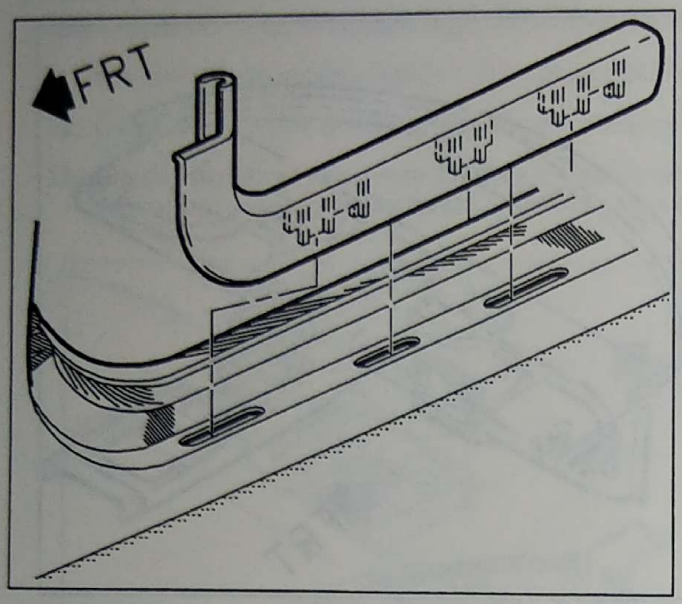
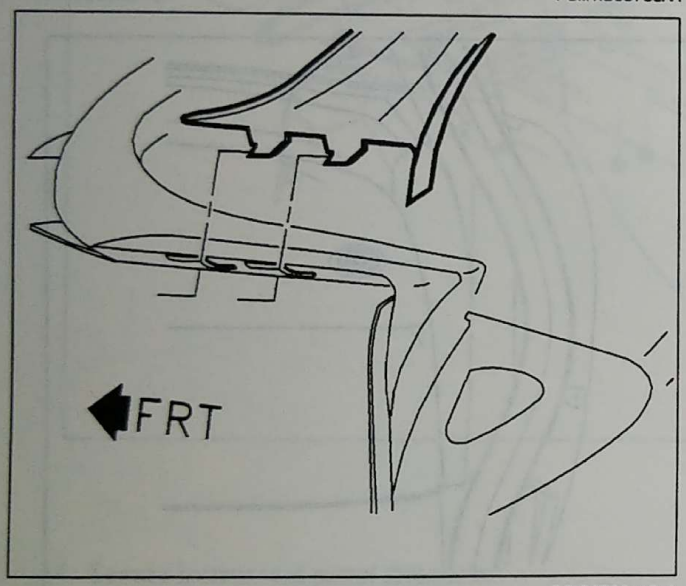


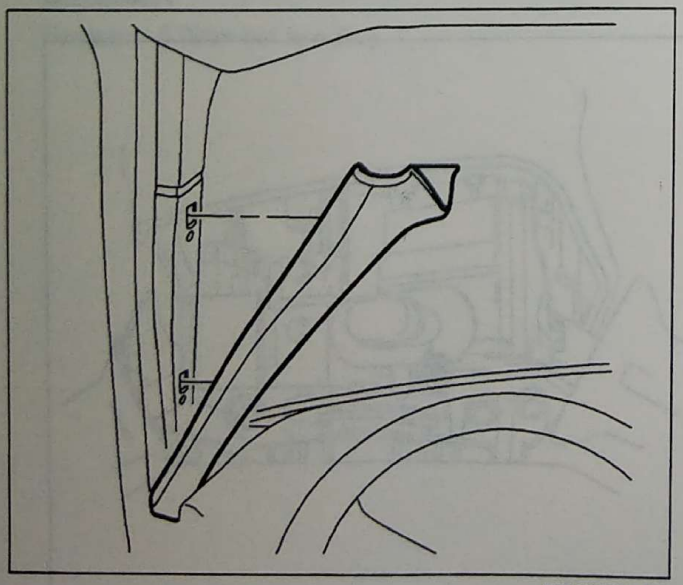
PSMVIS65733AA

22. Locate carpet retainer to door opening.
23. Firmly seat carpet retainer into weather.
24. Snap clips into slots in inner rocker pan.



PSMVIS66448AA

25. Insert tabs on bottom of garnish molding into instrument panel.
26. Push molding downward and forward past A-pillar structure.

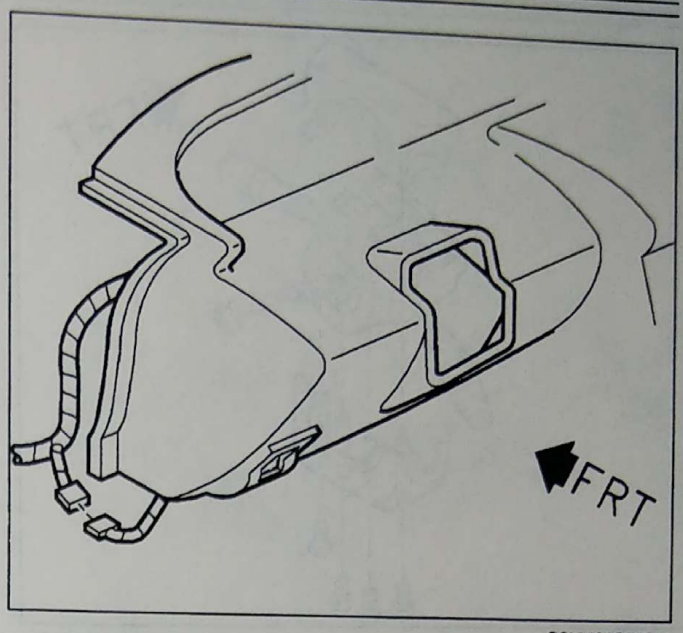


PSMVIS66447AB

27. Push molding to structure pressing forward and outward to insure proper fit to instrument panel, headlining and door seal.
28. Align clips on garnish molding to slots in A-pillar and press firmly at clip locations.
29. Position flap on door weatherstrip over windshield garnish molding.

CamScanner

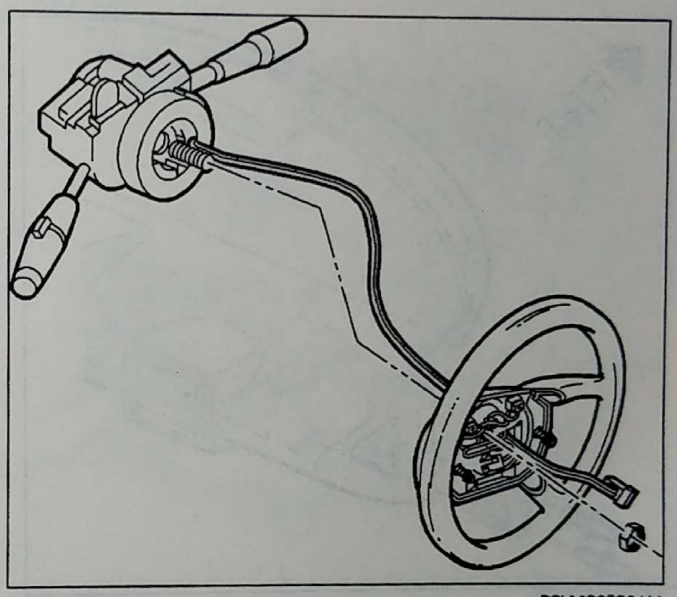
30. Connect park brake switch connector.



PSMMS65865AA

31. Route SIR cable through steering wheel. Install steering wheel to column.
32. Connect horn wire connector.
33. Install steering wheel nut.

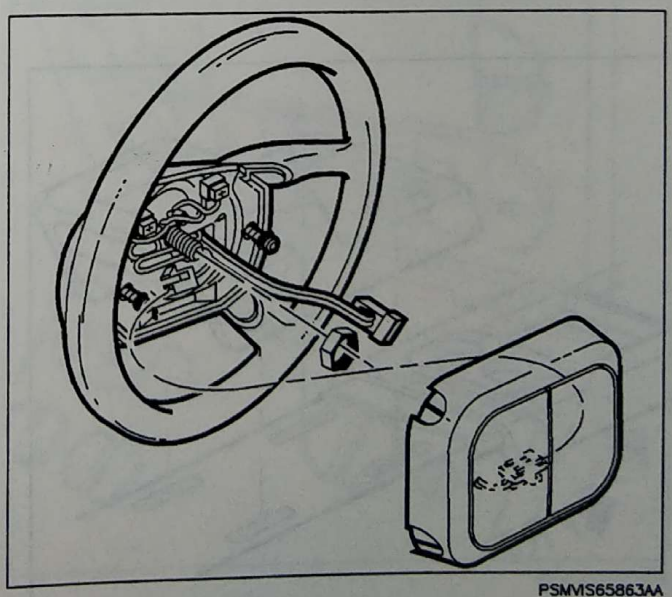
Torque: **42 N•m (31 ft−lbs)**



PSMMS65864AA

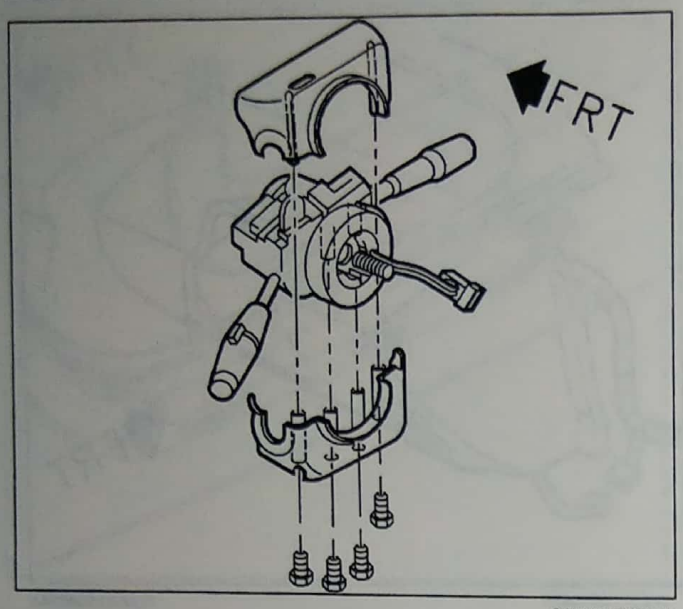
34. Route yellow SIR inflator module wire harness within the steering wheel hub forming an "S" shape with wire and connect SIR inflator module connector.
35. Install CPA, to connector.
36. Install inflator module to steering wheel.

Torque: **10 N•m (89 in−lbs)**



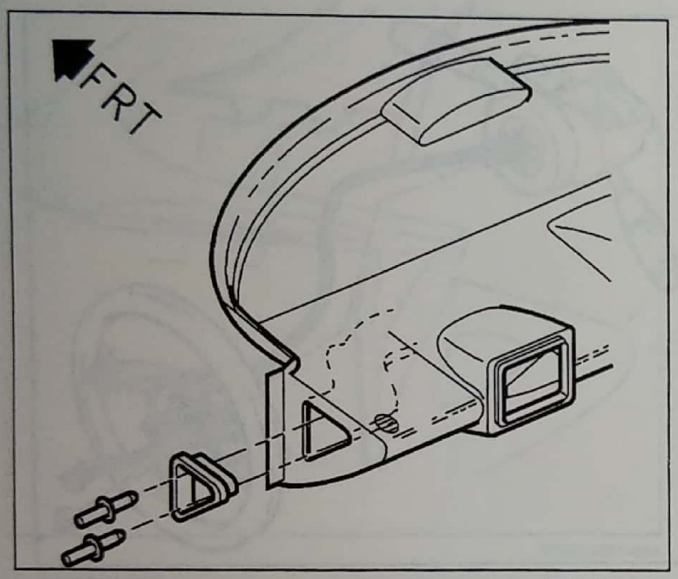
PSMMS65863AA

CamScanner



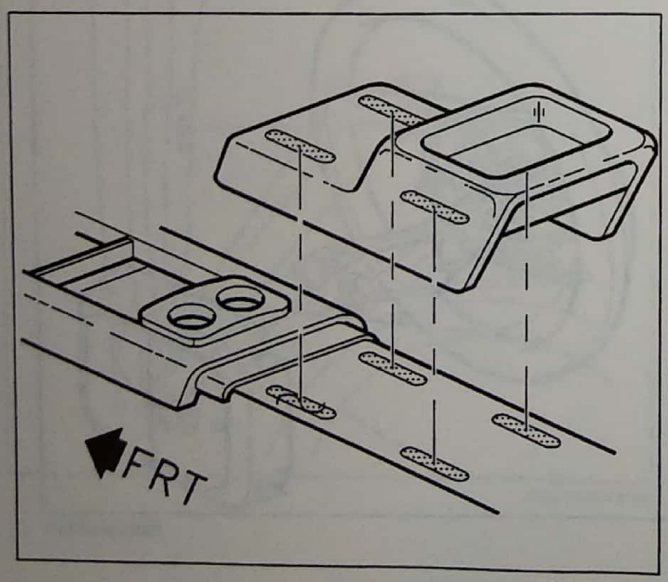
PSMVIS65827AA

37. Align lower steering column trim cover to steering column. Install and tighten inner screws.
38. Align upper steering column trim panel to steering column and install outer screws in lower steering column trim panel. Tighten outer screws.



PSMVIS65736AA

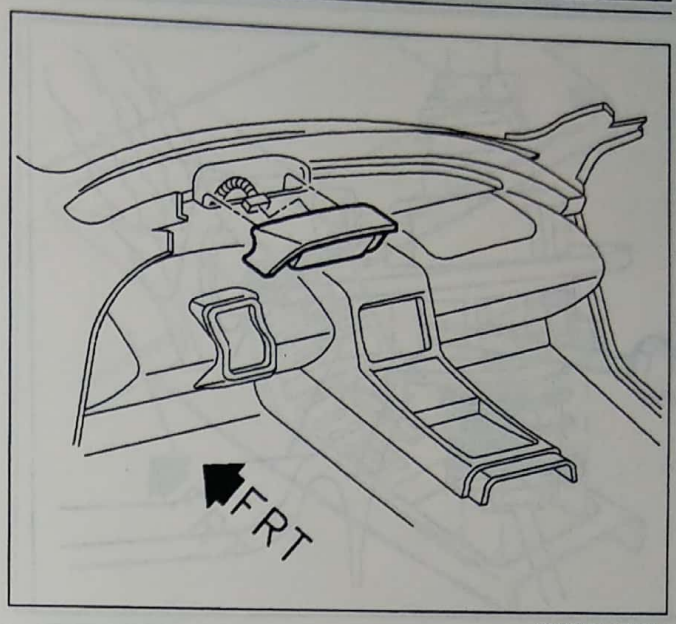
39. Install left and right front side door air outlets on side of the instrument panel using new fasteners.



PSMVIS65735AA

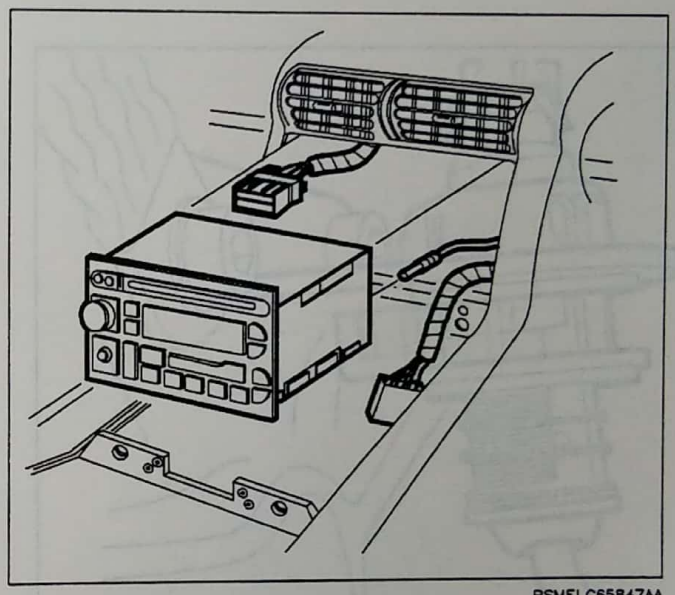
40. Install arm rest

41. Push harness connector into socket on instrument panel cluster. Verify connection is made, seated and locked.
42. Install instrument panel cluster into instrument panel by pushing forward and downward.



PSMELC66359AA

43. Connect radio harness to radio, then antenna lead to radio. Verify both connections are seated properly.
44. Make sure antenna and harness are up and out of the way of the radio bracket. Slide radio into opening until the radio is seated and the radio fits tightly to the console. You may hear a click as the radio tab locks into the bracket.



PSMELC65847AA

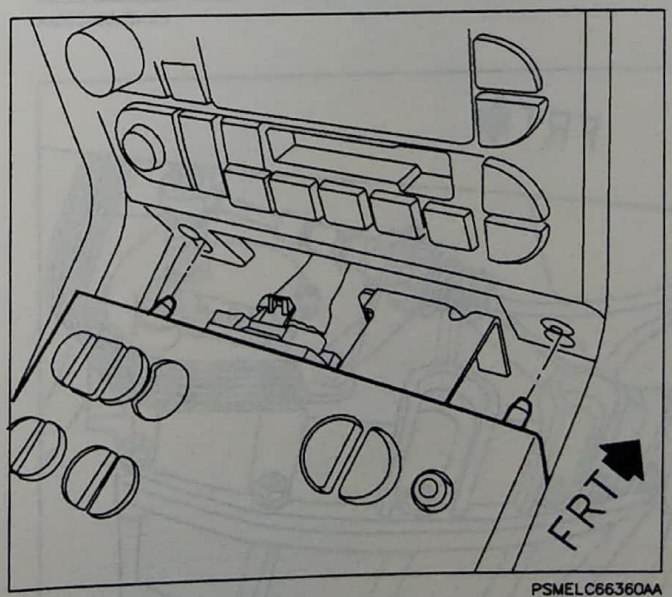
45. Cover the radio face with a rag for protection during RSA installation. Install shift cable housing into shift bracket and connect and secure shift cable to shifter. Be sure clip lock tab is in place.
46. Connect wire harness connector to RSA.
47. Align RSA locator tabs to front of instrument panel and push down on the rear of the RSA.
48. Install TORX™ fasteners.

Torque: 6 N•m (53 in−lbs)

IMPORTANT: You must adjust shift cable at final drive unit.

49. Adjust shift cable:

IMPORTANT: The shift cable must be attached to the RSA with the RSA secured in position. Shift handle must be placed in neutral before cable adjustment is performed.



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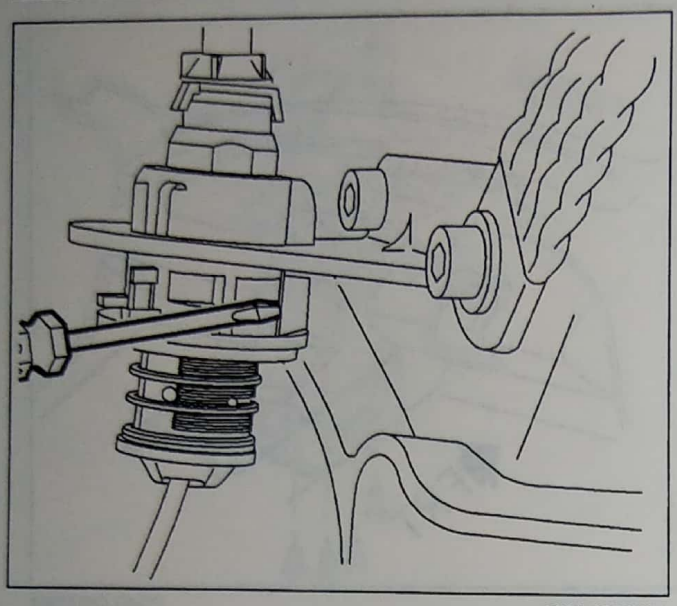
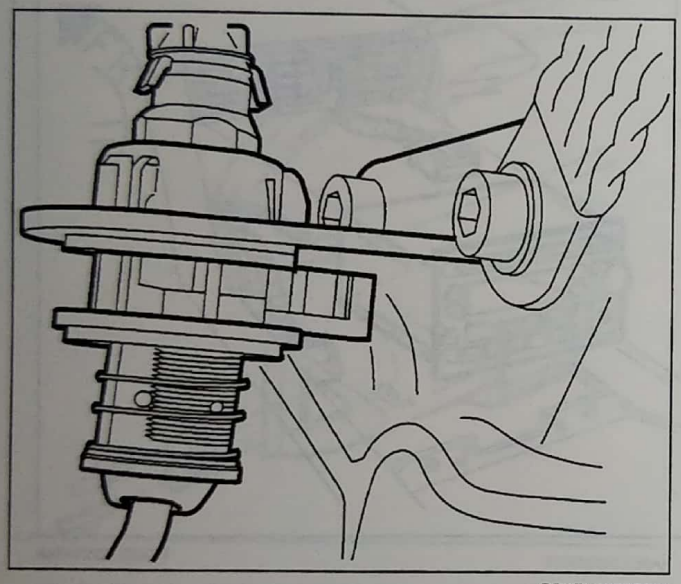


PSMELC66365AA

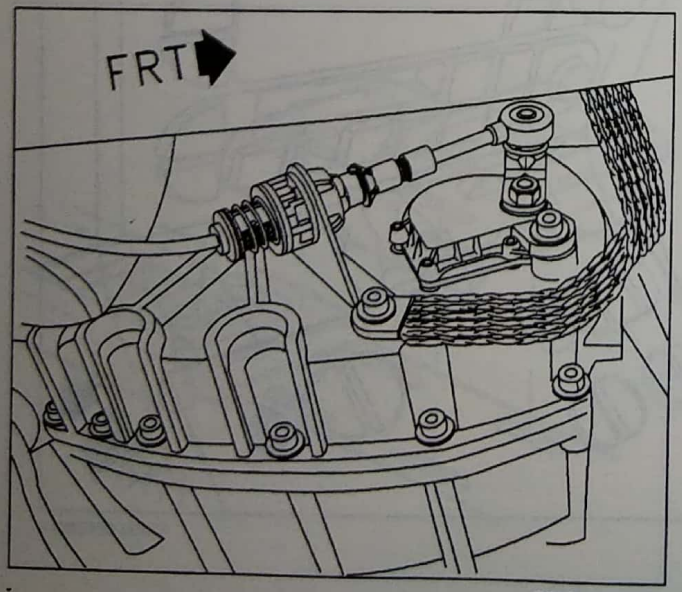
a. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in the "Body/Repair Service Manual.")

b. Unlock U-shaped adjustment collar. Collar is located aft of drive unit bracket, and will unlock by inserting a pocket screwdriver into gap and prying towards drive unit.



PSMELC66366AA

IMPORTANT: About 13mm (1/2 in.) movement necessary to insure unlock position.



PSMELC66364AA

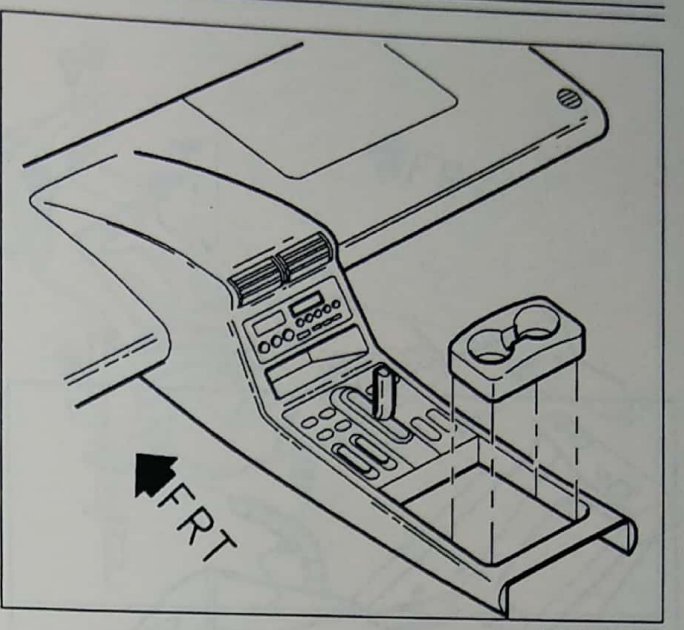
c. Verify shift lever is in neutral. Push U-shaped collar into lock position. Collar will move to right side of vehicle.

d. By hand shift park/lock lever to the full counterclockwise position (DRIVE) then move one detent in the clockwise direction (NEUTRAL).

e. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in the "Body/Repair Service Manual."

NOTICE: If shift cable has been removed more than six times at either end, for any reason, the cable must be replaced.

50. Install cup holder to center console.

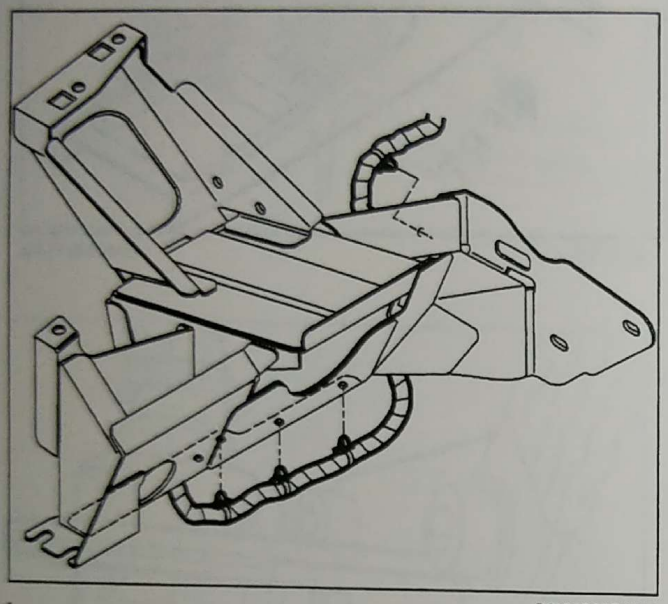


PSMMS65734AA

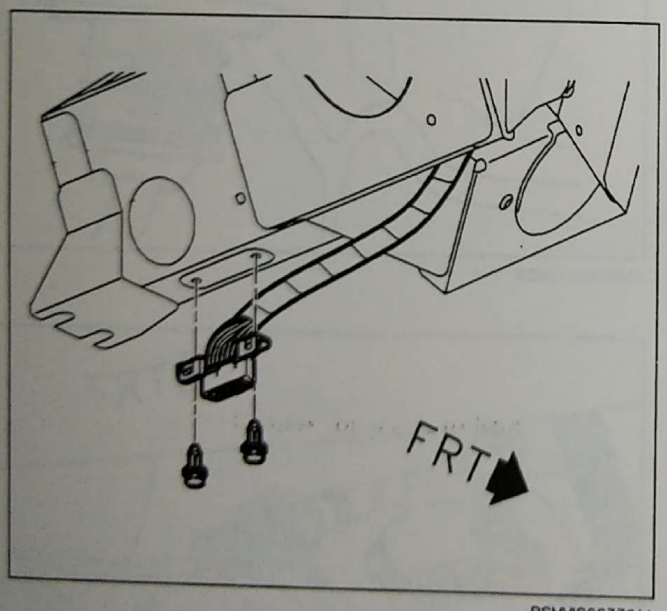
STEERING COLUMN SUPPORT

REMOVAL

1. Disable the SIR system. (Refer to "Disabling the SIR System" in this manual.)
2. Remove steering column. (Refer to "Steering Column" removal procedures in this manual.)
3. Unclip wire harness rose buds from steering column support.



PSMVIS66340AA



PSMVIS66339AA

4. Remove data link connector (DLC) from steering column support.
5. Loosen master cylinder nuts at front of dash.

6. Remove bolts and nut from steering column support.

IMPORTANT: Bolts at base of windshield will need to be removed with an open-end wrench.

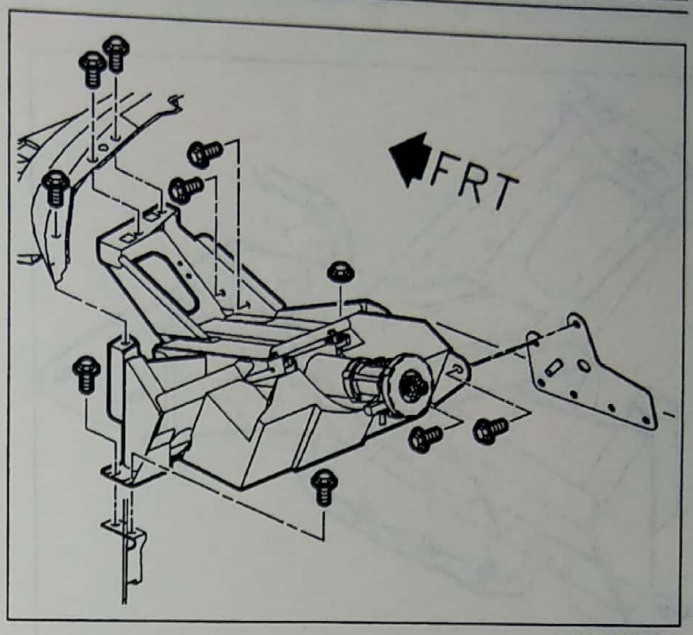
7. Remove steering column support from vehicle.

INSTALLATION

1. Load steering column support into vehicle. Hand tighten bolts and nuts.
2. Tighten master cylinder nuts at front of dash.

Torque: 27 N•m (20 ft−lbs)

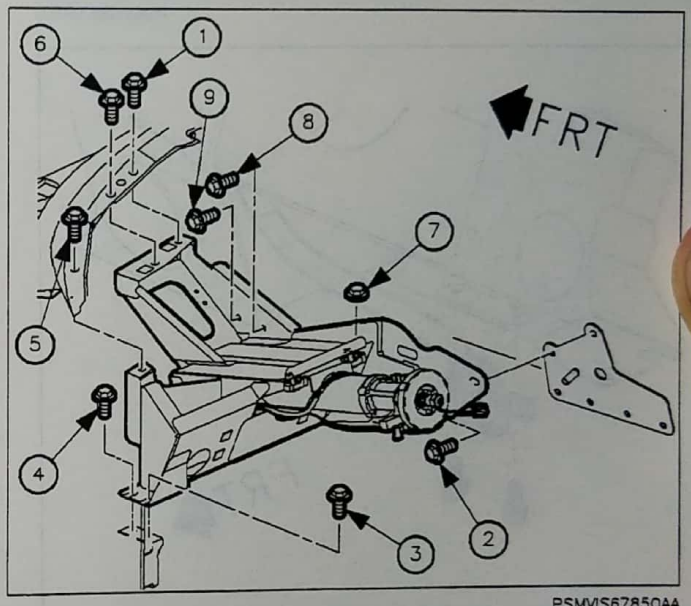
3. If drivers side knee bolster energy absorber is retained with bolts go to step 4 for torque sequence of steering column support. If drivers side knee bolster energy absorber is retained with dual-lock go to step 5 for torque sequence of steering support.



PSMIS66719AA

4. Tighten steering column support bolts and nut in sequence shown.

Torque: 25 N•m (19 ft−lbs)

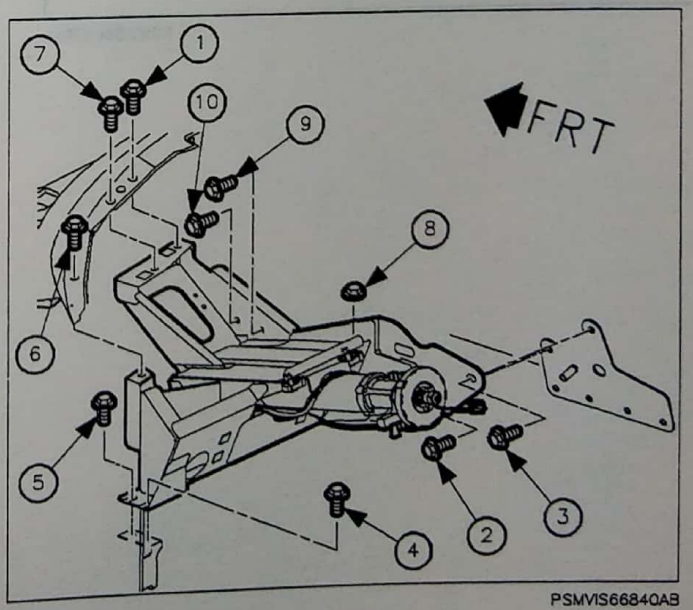


PSMIS67850AA

5. Tighten steering column support bolts and nut in sequence shown.

Torque: 25 N•m (19 ft−lbs)

IMPORTANT: After tightening steering column support and brake pedal bracket bolts and nuts, check brake pedal movement for binding.



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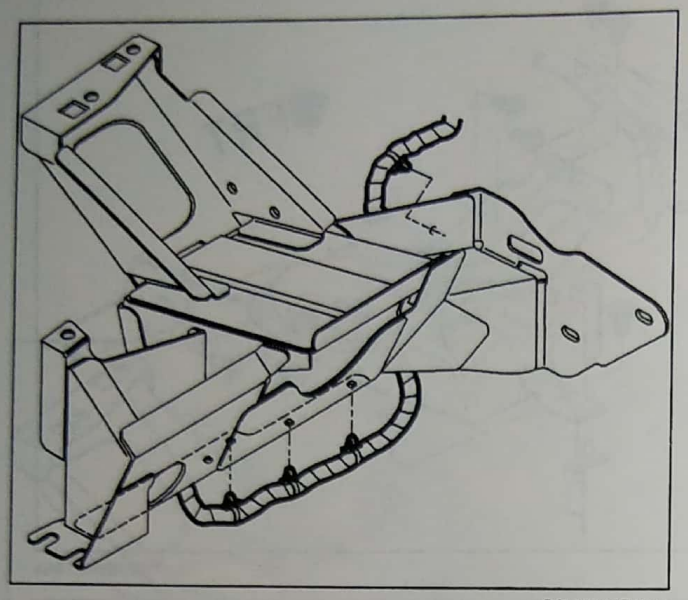
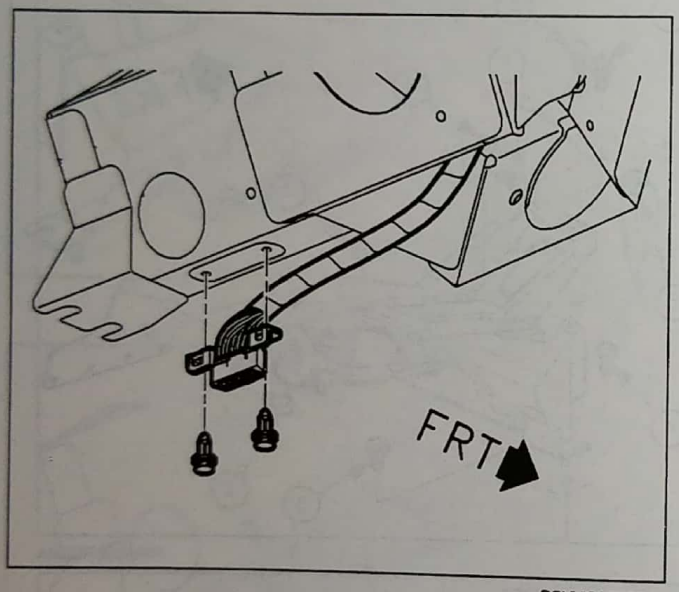


PSMVIS66340AA

6. Route wire harness and insert rose bud into steering column support as shown.



PSMVIS66339AA

7. Install DLC connector to steering column support.
8. Install steering column. (Refer to "Steering Column" installation procedure in this manual.)
9. Enable the SIR system. (Refer to "Enabling the SIR System" in this manual.)

NOTES

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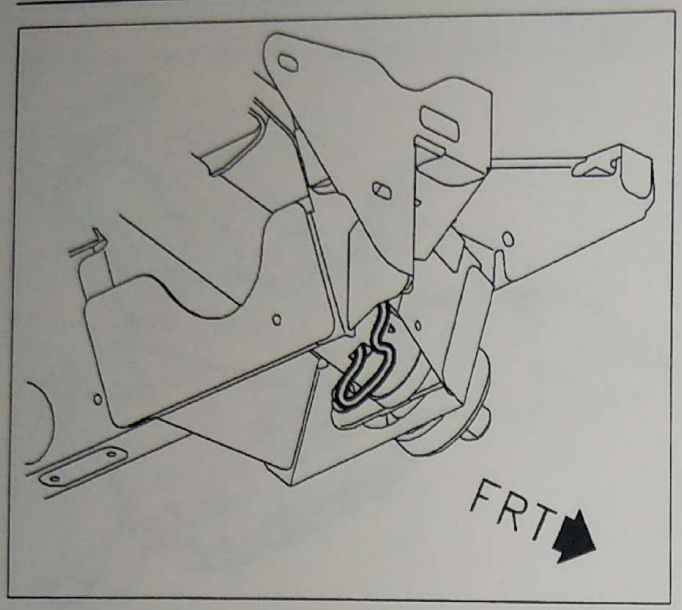

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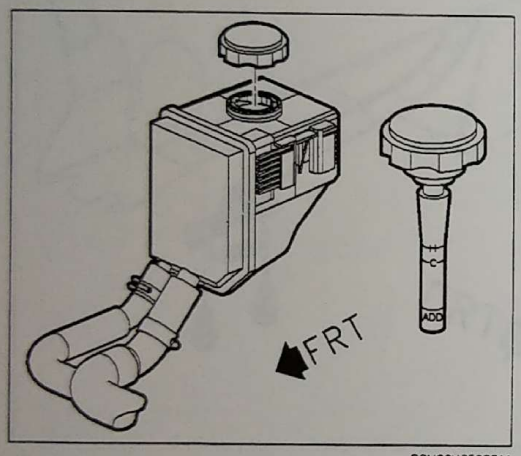


PSMGCH65983AA

STEERING GEAR PROCEDURES

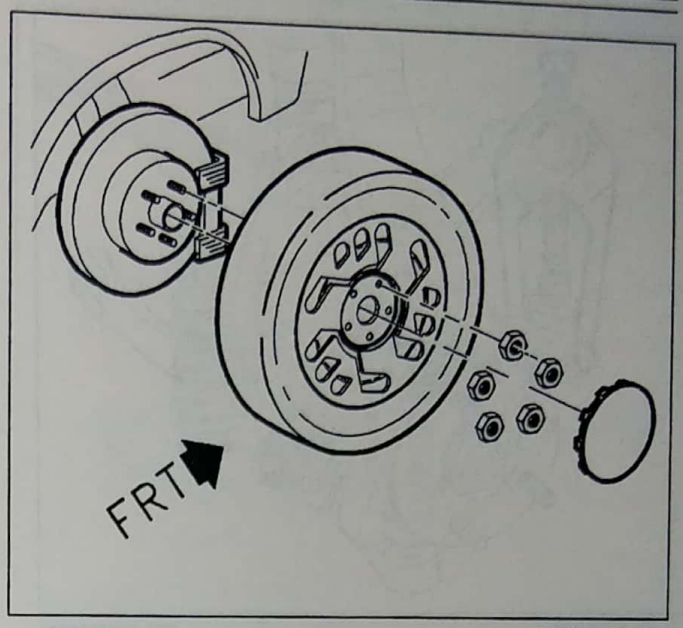
REMOVAL

IMPORTANT: Before replacing the steering rack you must first make sure to rotate the steering wheel to the right 180 degrees (1/2 turn) from the straight ahead position and secure the steering wheel so it will not turn. To lock the steering wheel a anti-rotation clip must be installed through the opening at the bottom of the column. Anti-rotation clips are available from service parts. Locking the column prevents the wheel from turning so the SIR clockspring cannot be damaged.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
2. Lift hood and remove power steering reservoir cap. Evacuate power steering fluid from reservoir.
3. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)
4. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

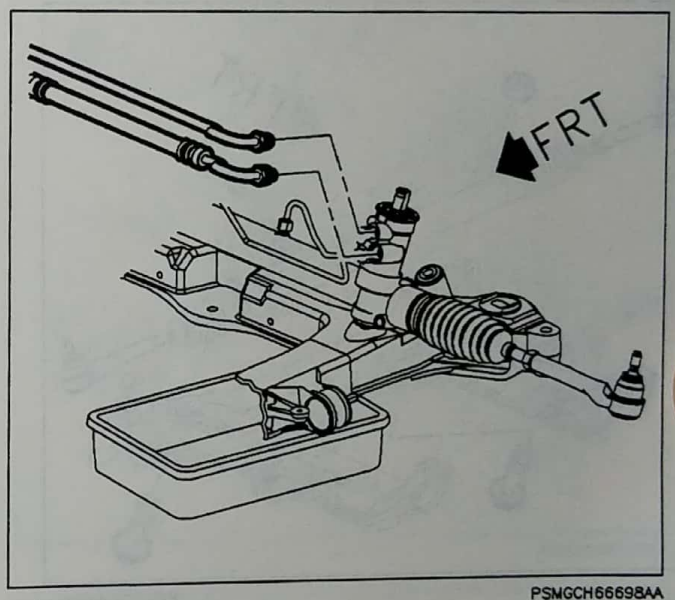
5. Remove front wheels.



PSMGCH65814AA

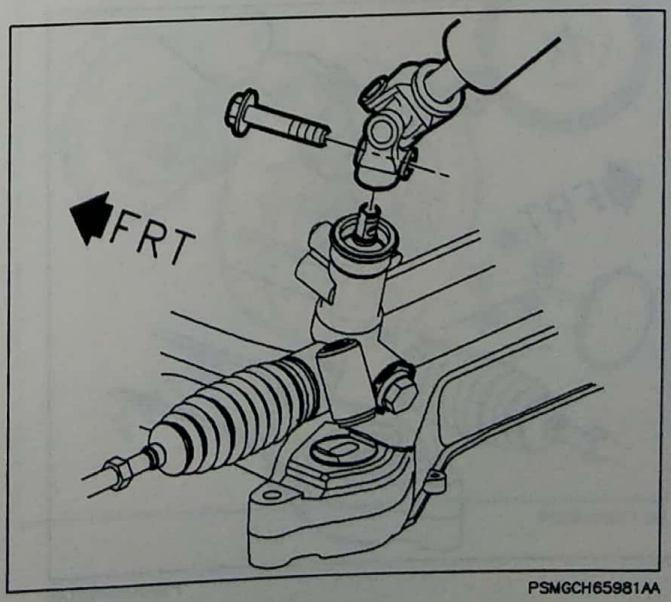
IMPORTANT: Place an approved drain container under pressure and return hoses at steering gear.

6. Disconnect power steering inlet and outlet fittings from steering gear and allow the system to drain.
7. Loosen intermediate cover from steering gear and move up enough to access pinch bolt.



PSMGCH66698AA

8. Remove pinch bolt.
9. Remove and discard tie rod end cotter pins.
10. Remove tie rod end to knuckle castle nuts.



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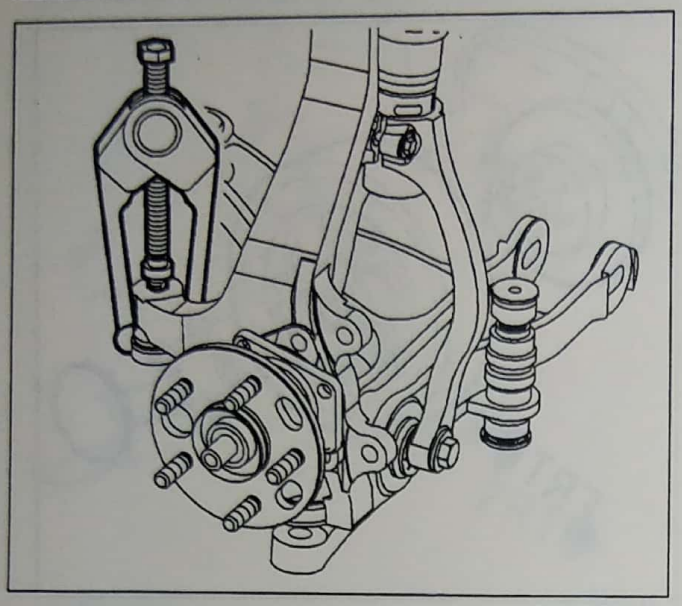


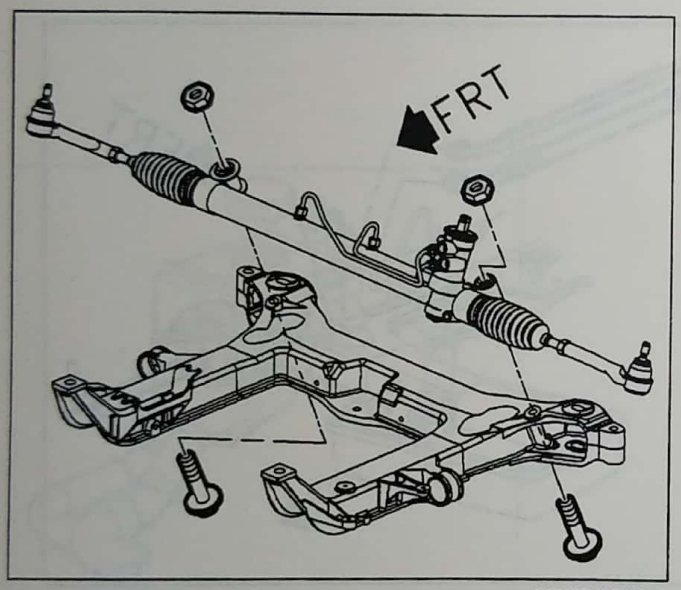
PSMGCH66169AA

11. Using SA91100C (or equivalent), seperate tie rod ends from steering knuckle.

NOTICE: Do not attempt to separate the joint using a wedge type tool, because the seal may be damaged.

12. Remove steering gear-to-cradle fasteners and remove steering gear from vehicle through left wheel well.

NOTICE: Remove steering gear from left side of vehicle, rotating it counterclockwise as needed to clear the wheelwell and steering knuckle. Insure that the rack assembly and components do not get caught on wire harness or shift cable during removal.



PSMGCH65987AA

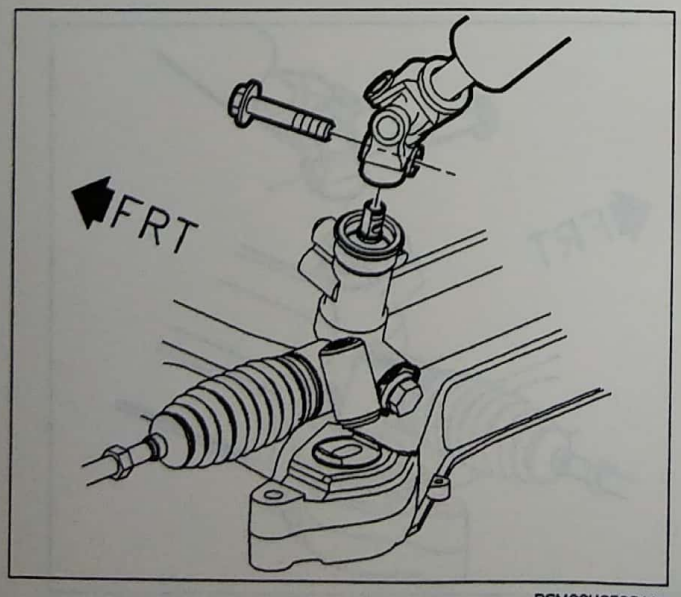
INSTALLATION

1. Place steering gear in vehicle.

IMPORTANT: Install steering gear from the left side of vehicle, with the intermediate shaft pin at approximately the 8 o'clock position and rotating it clockwise as necessary to set it in place.

2. Install steering gear-to-cradle bolts and **new** nuts. Tighten bolts.

Torque: 60 N•m (44 ft−lbs)



PSMGCH65981AA

3. Install intermediate shaft onto the steering gear and torque pinch bolt.

Torque: 47 N•m (35 ft−lbs)

NOTICE: The pin on the steering gear has a notch on one side. This has to be lined up with the side of the intermediate shaft knuckle in which the bolt goes through, or you will not be able to install the bolt. If it becomes necessary to align these, turn the steering wheel back to the left (back to center position) as needed.

IMPORTANT: Use Loctite® 242 Threadlocker (or equivalent) on thread of pinch bolt.

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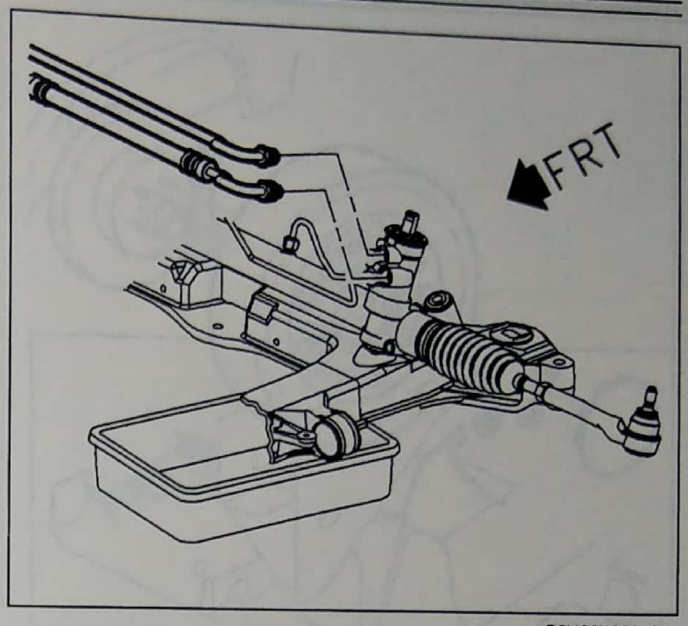
4. Connect power steering pressure and return hoses to steering gear.

Torque: 28 N•m (21 ft−lbs)



PSMGCH66698AA

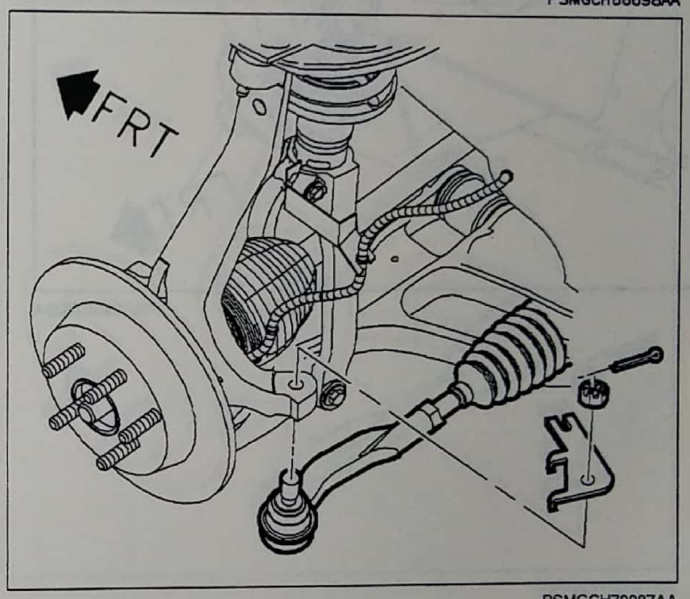
IMPORTANT: The rod end threads must be thoroughly cleaned.

5. Install tie rod ends into steering knuckles along with bracket.

Torque: 23 N•m (17 ft−lbs)

NOTICE: Install tie rod end to knuckle in direction shown, aligning bracket over stud and secure with castle nut. Apply additional torque as required to align first nut slot with stud hole and install new cotter pin. Always tighten the nut to align it; NEVER LOOSEN IT. Bend back access cotter leg lengths around nut.

IMPORTANT: If necessary, center steering gear by making sure both tie rod ends have the same number of threads showing.



PSMGCH70087AA

6. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

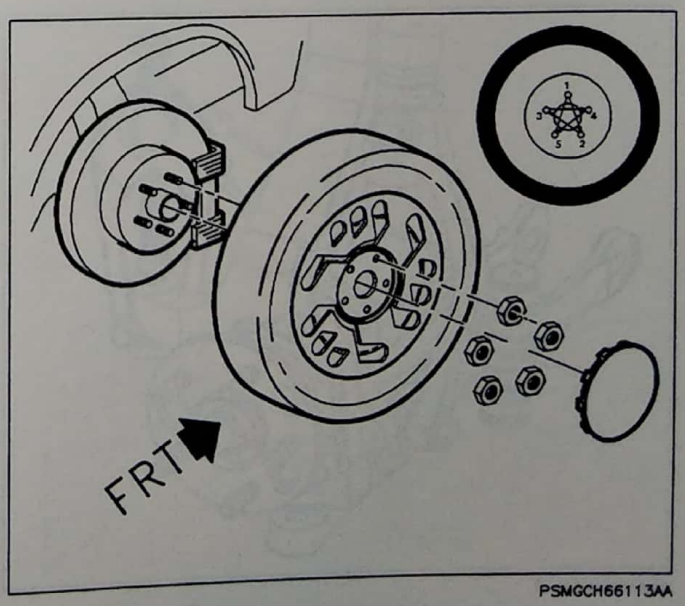
Torque: 6 N•m (53 in−lbs)

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

7. Position wheel on hub.
8. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

9. Lower vehicle from hoist.



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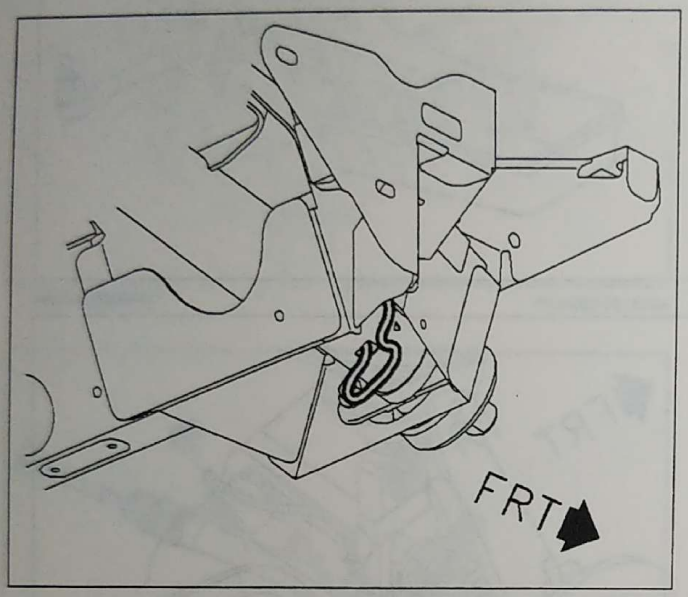
NOTICE: Remove anti-rotation clip from steering column.

10. Fill power steering system with fluid

NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.



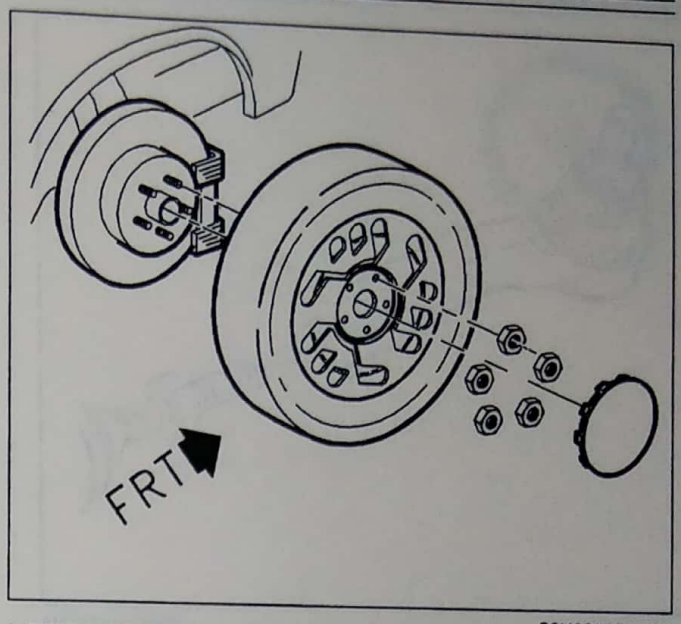
PSMVIS66762AA

11. Bleed power steering system. (Refer to "Power Steering Bleed" procedure in this manual.)
12. Enable high voltage. (Refer to "High Voltage Enable" procedure in this manual.)
13. Power vehicle up and clear BPM codes. If the vehicle does not power-up, refer to the "High Voltage" section of this manual.
14. Set toe. (Refer to "Wheel Alignment" in "Alignment, Wheels & Tires" procedure in this manual).

OUTER TIE ROD

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)
2. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)
3. Remove wheel and tire.
4. Remove and discard outer tie rod end cotter pin.



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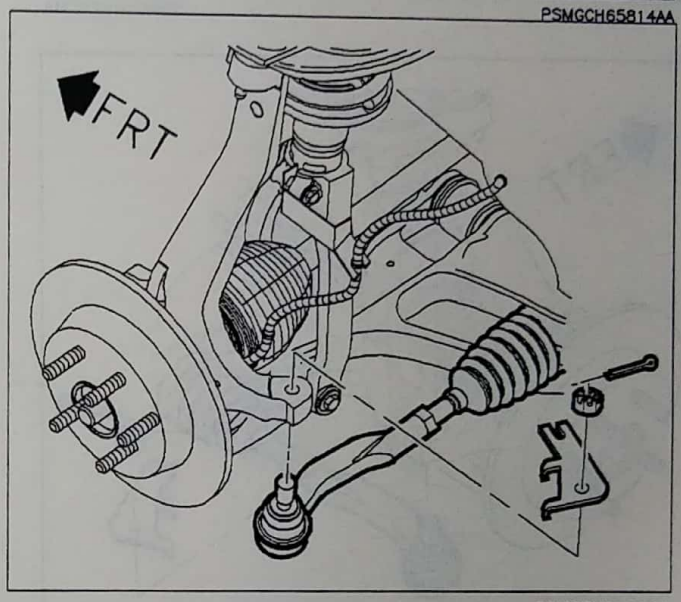
5. Remove tie rod end-to-knuckle castle nut.
6. Loosen outer tie rod-to-inner tie rod jam nut.



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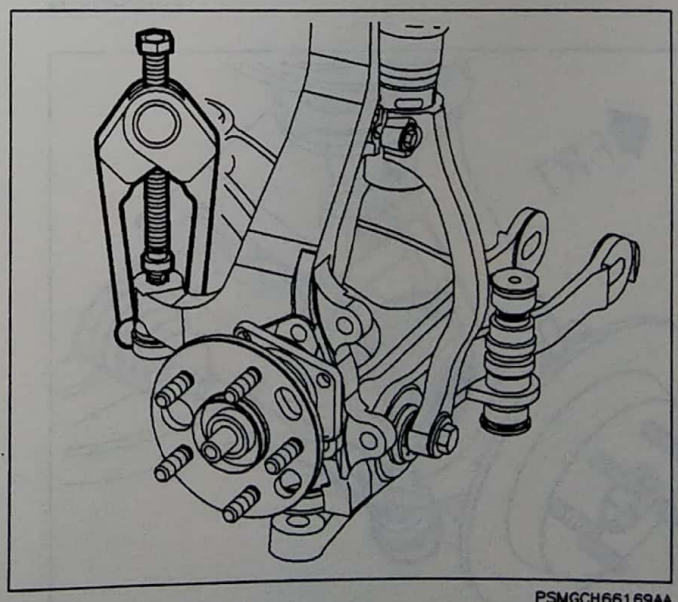
7. Using SA91100C (or equivalent), separate tie rod end from steering knuckle.



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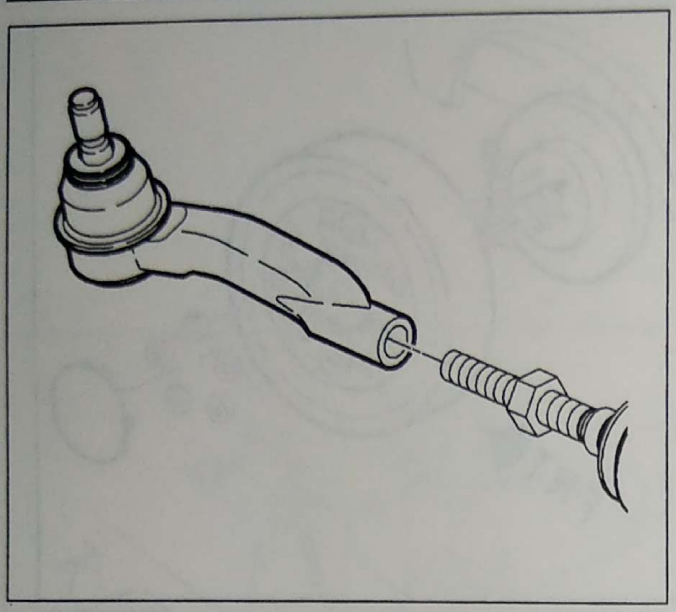

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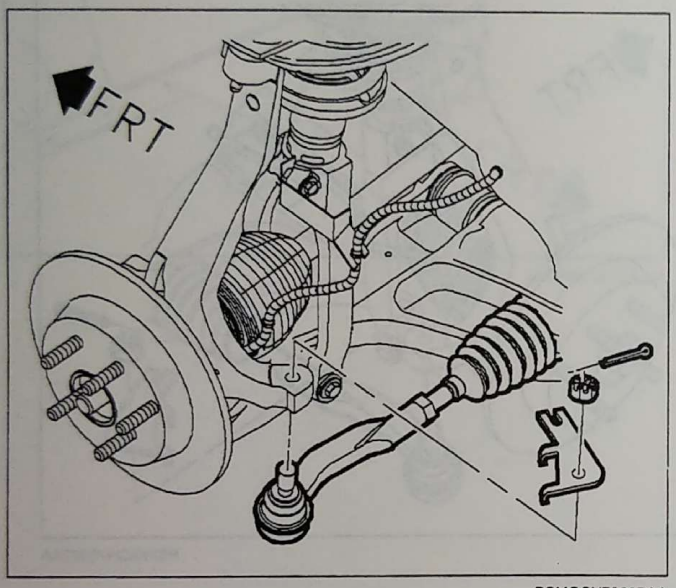
NOTICE: Do not attempt to separate the joint using a wedge type tool, because the seal may be damaged.

8. Unthread outer tie rod from inner tie rod and remove from vehicle.



PSMGCH70087AA

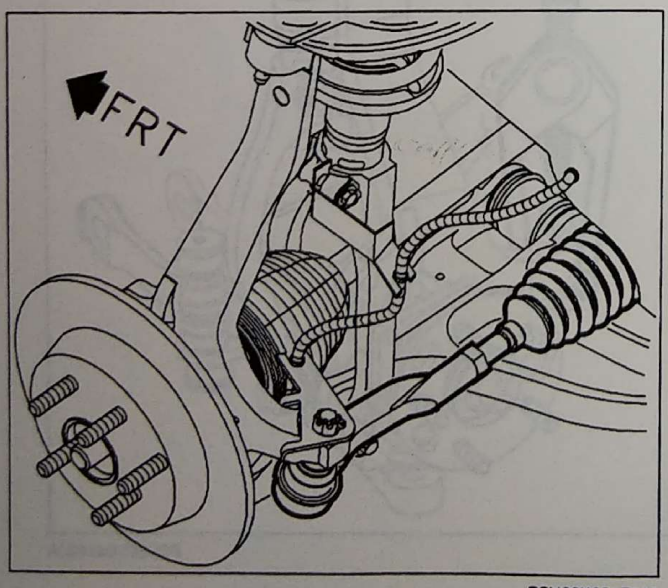
INSTALLATION

1. Thread outer tie rod onto inner tie rod.

IMPORTANT: The rod end threads must be thoroughly cleaned.

2. Install outer tie rod end into steering knuckle and torque castle nut.

Torque: 23 N•m (17 ft−lbs)



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NOTICE: Install tie rod end to knuckle in direction shown, aligning bracket over stud and secure with castle nut. Apply additional torque as required to align first nut slot with stud hole and install new cotter pin. Always tighten the nut to align it; NEVER LOOSEN IT. Bend back access cotter leg lengths around nut.

3. Install new cotter pin into tie rod castle nut.
4. Hand tighten inner tie rod-to-outer tie rod jam nut. Torque during alignment procedures.
5. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

Torque: 6 N•m (53 in−lbs)

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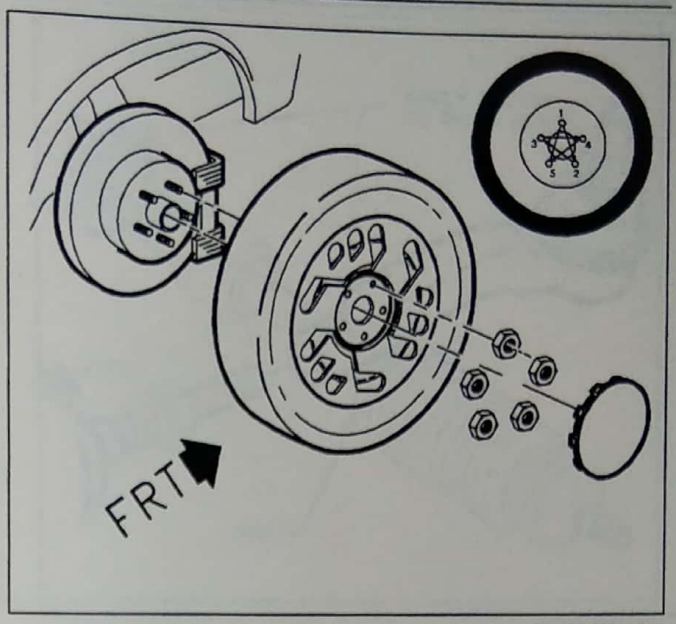
NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

6. Position wheel on hub.
7. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

8. Set toe. (Refer to "Wheel Alignment" in "Alignment, Wheels & Tires" procedure in this manual.)



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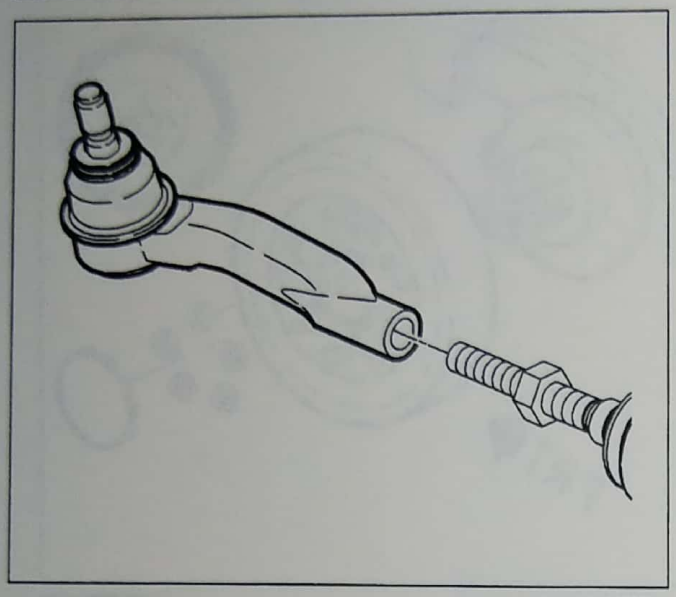
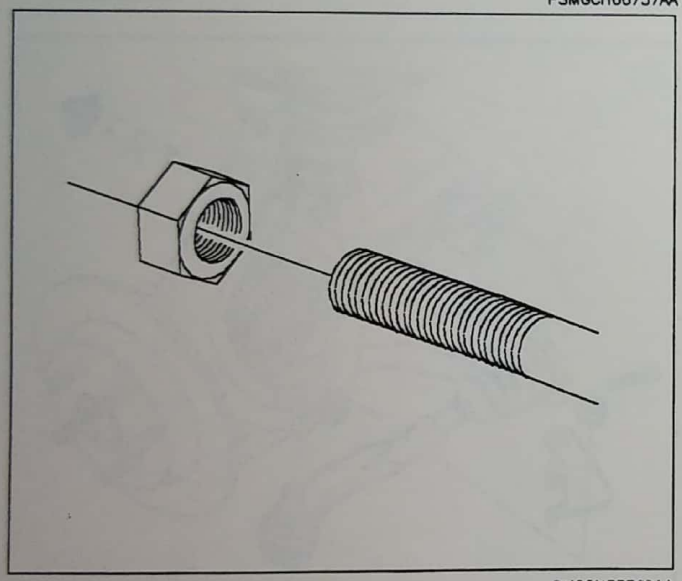


PSMGCH66737AA

STEERING GEAR BOOT

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)
2. Remove underbody front air deflector assembly. Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)
3. Remove wheel and tire.
4. Remove outer tie rod end as previously described.



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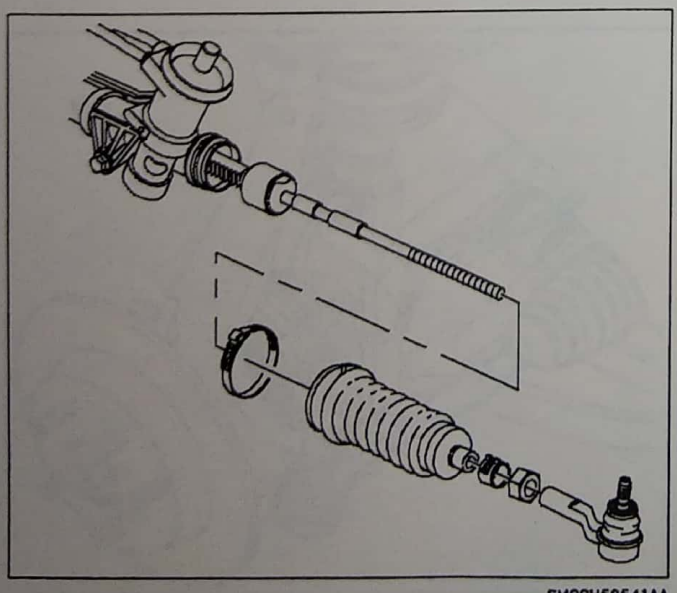
5. Remove inner tie rod-to-outer tie rod jam nut from inner tie rod.

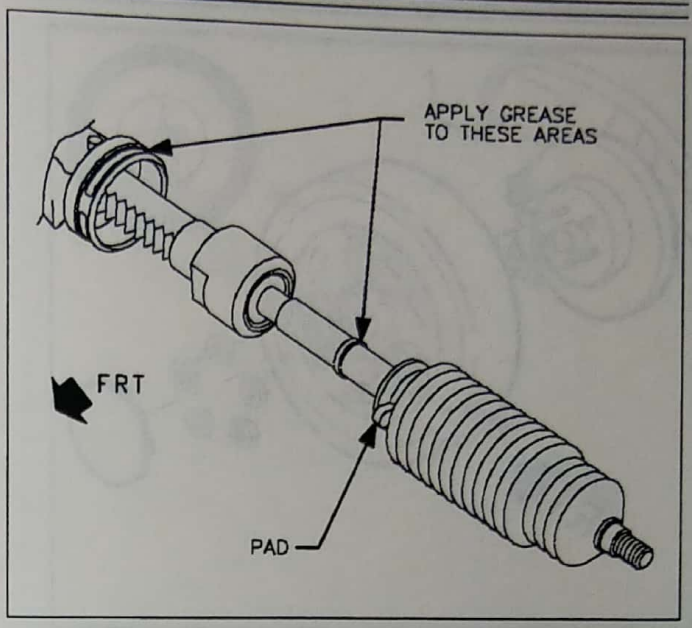


SMGCH59541AA

6. Remove boot clamp (tie rod end).
7. Remove boot clamp (steering gear housing end) with cutters and discard.
8. Remove steering gear boot from steering gear.

INSTALLATION

1. Install new boot clamp onto steering gear boot (steering gear housing end).
2. Apply grease in service kit to locations shown in illustration prior to boot installation. This grease provides a water barrier and must be used to protect internal gear components from corrosion.



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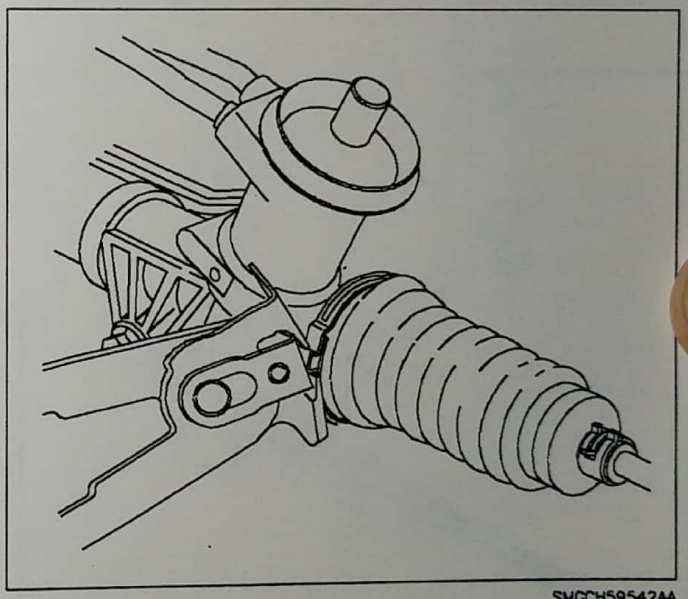
3. Install boot onto inner tie rod assembly, then slide boot along rod assembly until the large end of the boot is seated in the steering gear housing groove.

NOTICE: **The boot has a small pad near the clamp location on the housing end. The boot should be turned so that the pad is towards the front of the vehicle.**

NOTICE: **Boot must not be twisted or puckered.**

4. Crimp clamp on housing end of boot.
5. Install clamp on inner tie rod end of boot.
6. Install inner tie rod-to-outer tie rod jam nut.
7. Install outer tie rod and attach to knuckle as previously described.
8. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

Torque: 6 N•m (53 in–lbs)



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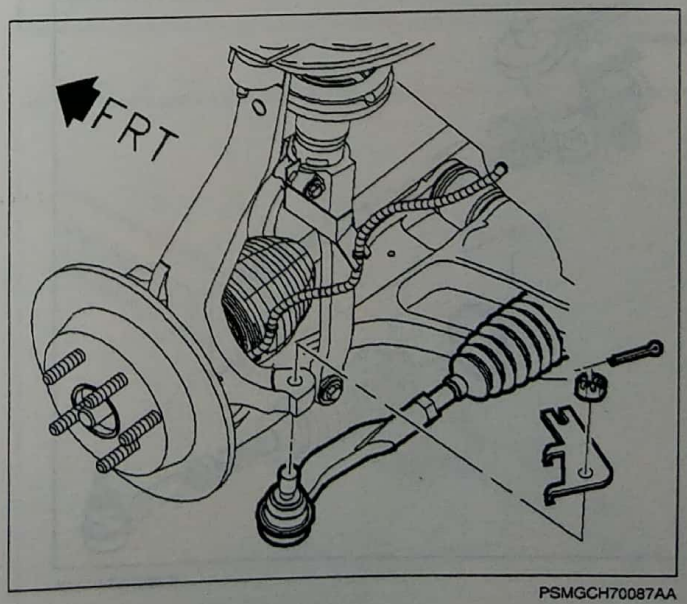

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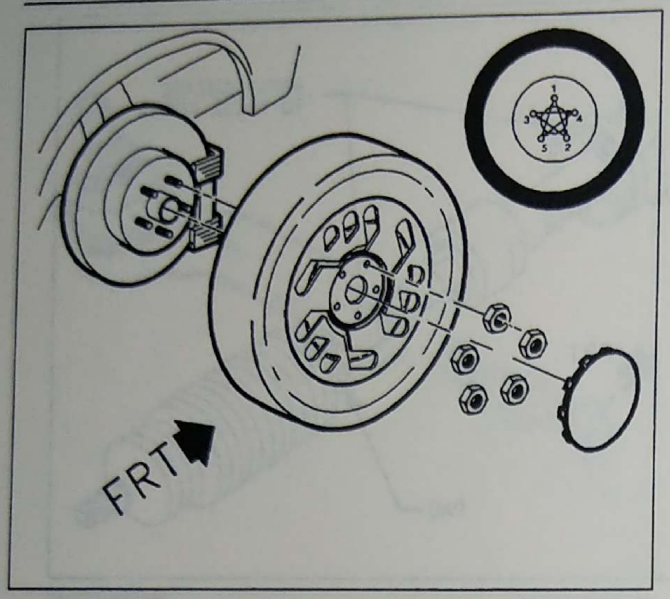


PSMGCH66113AA

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

9. Position wheel on hub.
10. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

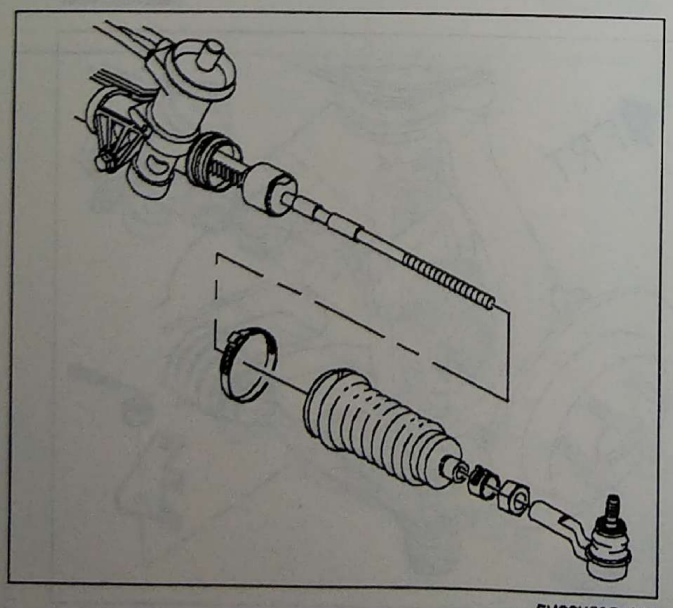
Torque: 120 N•m (89 ft−lbs)

11. Set toe. (Refer to "Wheel Alignment" in "Alignment, Wheels & Tires" procedure in this manual.)

INNER TIE ROD

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)
2. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)
3. Remove wheel and tire.
4. Loosen outer tie rod-to-inner tie rod jam nut.
5. Remove steering gear, following the appropriate procedure previously outlined.
6. Unthread outer tie rod from inner tie rod.
7. Remove outer tie rod jam nut.

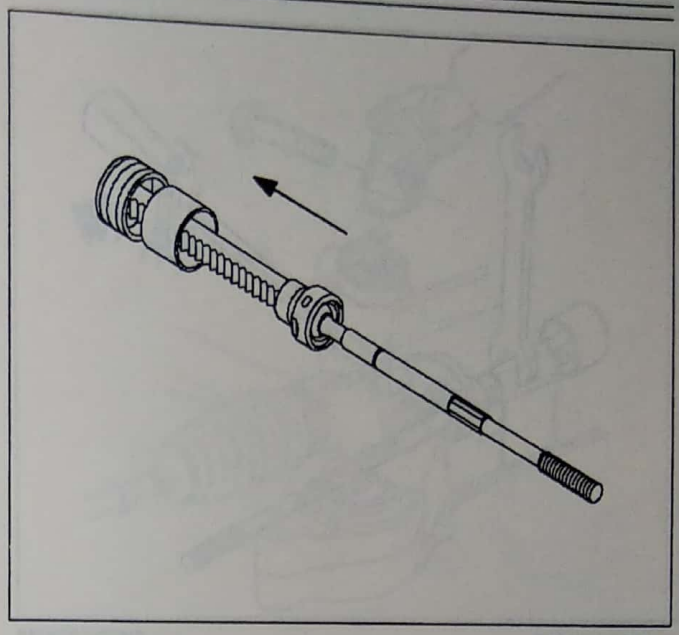


SMGCH59541AA

8. Remove steering gear boot.

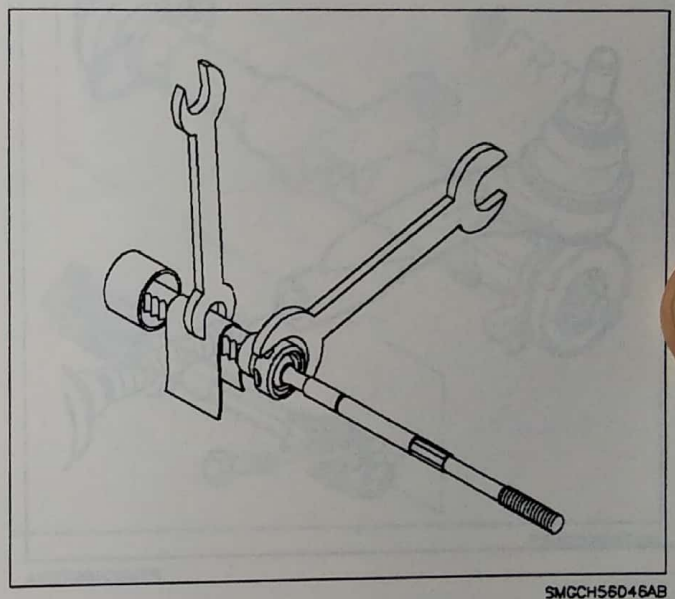
NOTICE: Steering gear rack must be held stationary during inner tie rod removal to prevent steering gear damage. Use an appropriate size wrench at the rack teeth to hold the rack during inner tie rod removal. Protect rack teeth with a shop rag. For right side inner tie rod removal, it will be necessary to remove the left side boot to access the rack teeth.

IMPORTANT: Slide collar towards gear teeth to access wrench flats.



SMGCH56045AB

9. Remove inner tie rod assembly from steering gear.



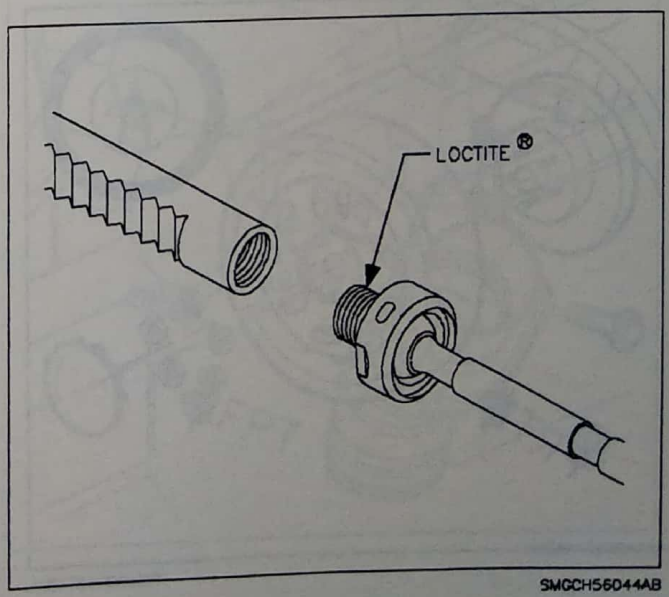
SMGCH56046AB

INSTALLATION

1. Remove old Loctite® from threads of rack and inner tie rod.

IMPORTANT: Threads must be clean prior to Loctite application. Make sure Loctite® Threadlocker (or equivalent) container expiration date has not passed. Do not use to much Loctite® Threadlocker (or equivalent). Use only enough to evenly coat the threads.

2. Apply Loctite® 242 Threadlocker (or equivalent) to inner tie rod threads.



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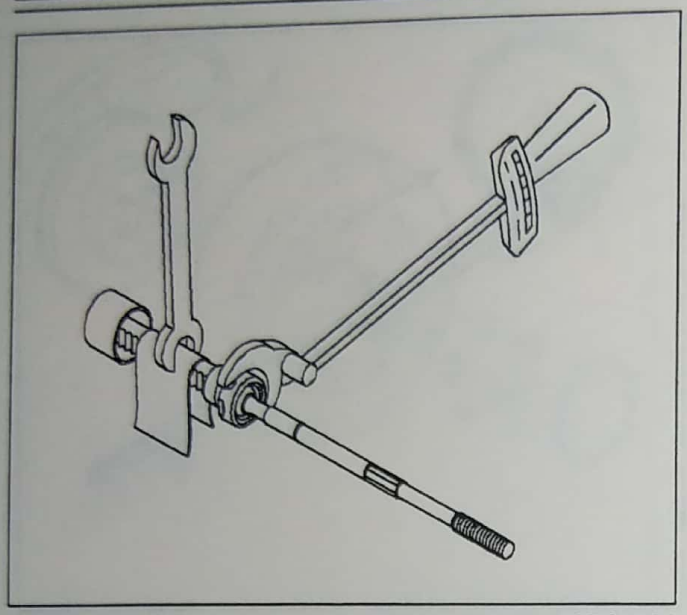


SMGCH56047AB

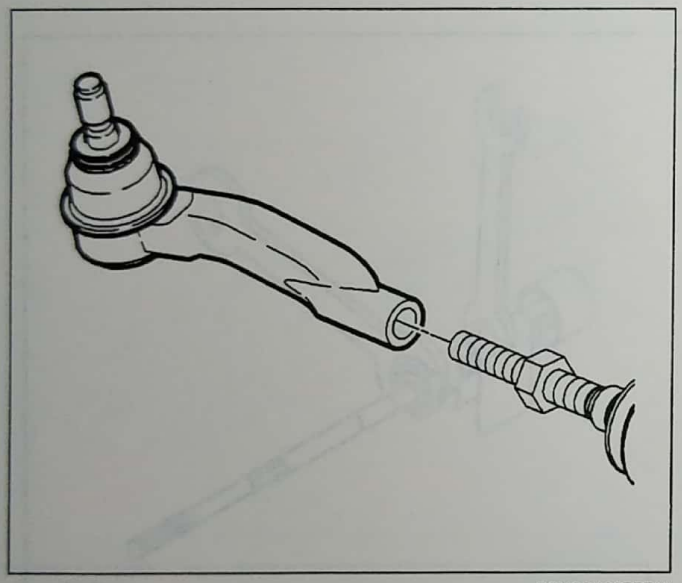
3. Install inner tie rod assembly onto steering gear.

Torque: 95 N•m (70 ft−lbs)

NOTICE: Steering gear must be held stationary during inner tie rod installation to prevent steering gear damage.

IMPORTANT: Slide collar back to original position.

4. Install steering gear boot onto steering gear.

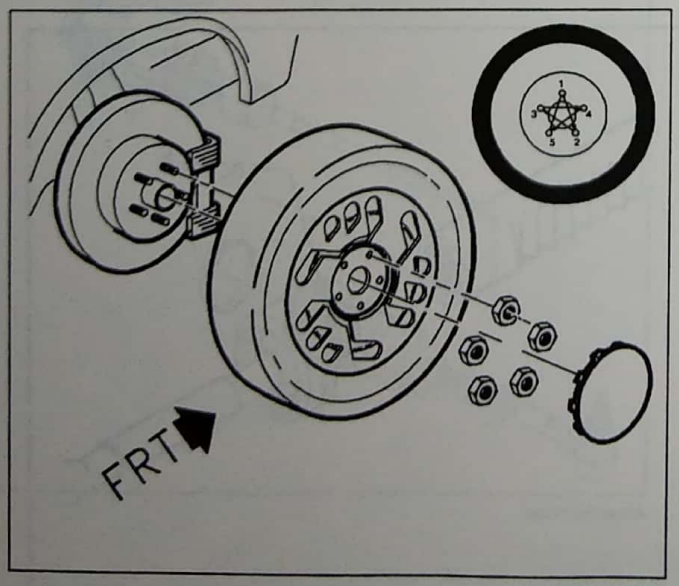


PSMGCH66737AA

5. Thread inner tie rod-to-outer tie rod jam nut onto inner tie rod.
6. Thread outer tie rod onto inner tie rod.
7. Install steering gear into vehicle using the appropriate procedure previously outlined.
8. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

Torque: 6 N•m (53 in−lbs)

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.



PSMGCH66113AA

9. Position wheel on hub.
10. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

11. Fill power steering system with fluid

NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

12. Bleed power steering system. (Refer to "Power Steering Bleed" procedure in this manual.)
13. Set toe. (Refer to "Wheel Alignment" in "Alignment, Wheels & Tires" procedure in this manual.)

CamScanner

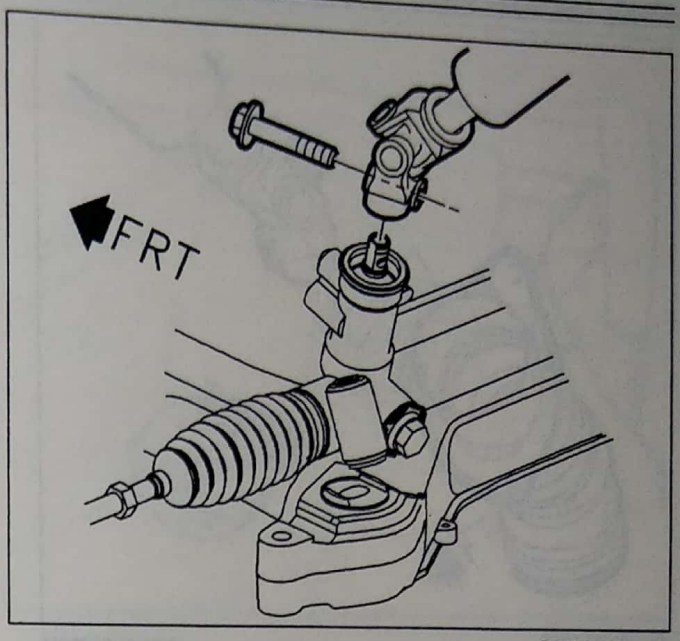
INTERMEDIATE SHAFT/COVER

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)
2. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

NOTICE: **Before removing the intermediate shaft, the steering wheel must be positioned in the straight ahead position. To lock the steering wheel a anti-rotation clip must be installed through the opening at the bottom of the column. Anti-rotation clips are available from service parts. Locking the column prevents the wheel from turning so the SIR clockspring cannot be damaged.**

3. Push up on intermediate shaft cover enough to access intermediate shaft pinch bolt.
4. Remove pinch bolt.
5. Disconnect intermediate shaft from steering gear.
6. Lower vehicle.
7. Disconnect intermediate shaft from steering column.



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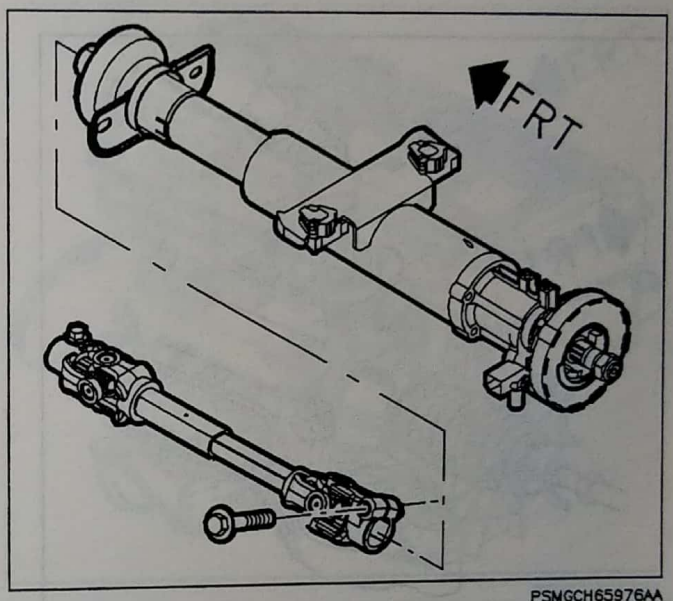
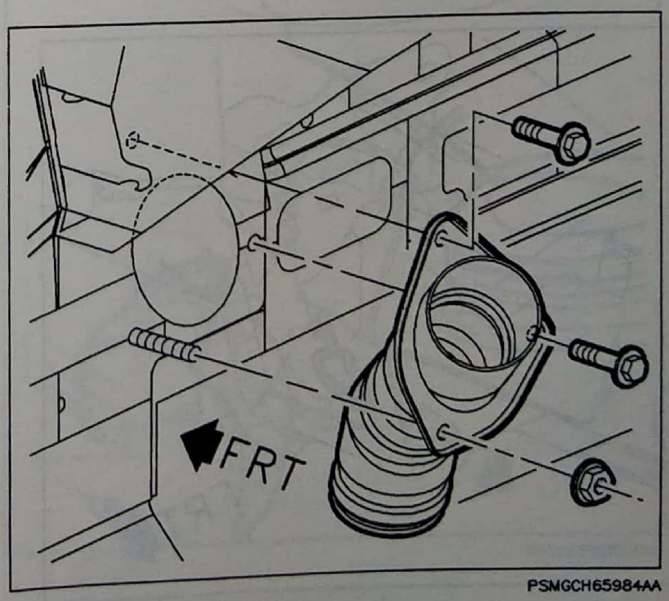


PSMGCH65976AA

8. From inside of vehicle, pull back dash mat to access two bolts and one nut securing intermediate shaft cover to front of dash.
9. Remove two bolts and one nut.
10. Remove intermediate shaft cover from inside the vehicle.



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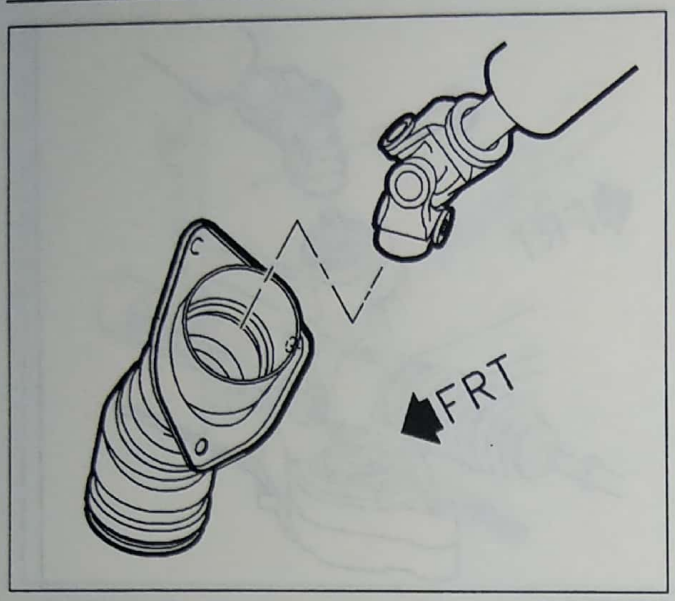


PSMGCH60909AA

INSTALLATION

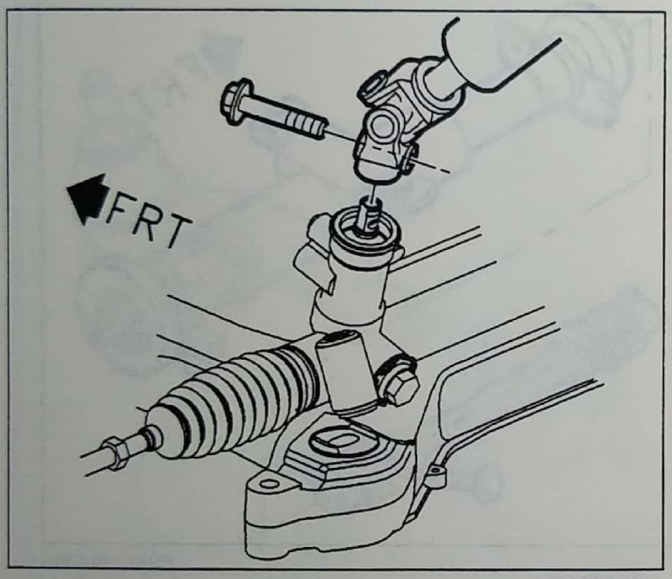
1. Slide intermediate shaft into cover.
2. From inside the vehicle, install the cover and intermediate shaft assembly.
3. Install the one nut securing intermediate shaft cover to front of dash.

Torque: 8 N•m (71 in−lbs)

4. Install two bolts securing intermediate shaft cover to front of dash.

Torque: 10 N•m (88 in−lbs)

5. Position intermediate shaft onto shaft from steering column.



PSMGCH65981AA

IMPORTANT: Use Loctite® 242 Threadlocker (or equivalent) on thread of pinch bolt.

6. Install intermediate shaft pinch bolt.

Torque: 47 N•m (35 ft−lbs)

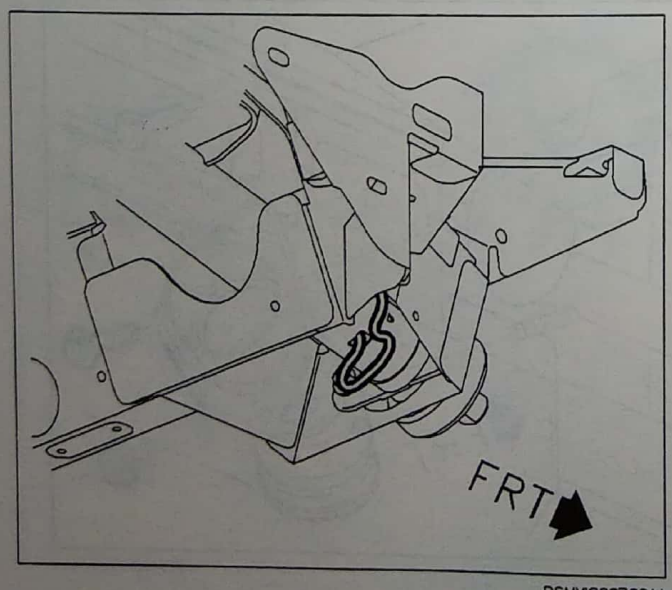
7. Raise vehicle.
8. Position intermediate shaft onto steering gear.
9. Install intermediate shaft pinch bolt.

Torque: 47 N•m (35 ft−lbs)

10. Attach cover to steering gear.
11. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

Torque: 6 N•m (53 in−lbs)

12. Lower vehicle from hoist.



PSMVIS66762AA

13. Remove anti-rotation clip.

POWER STEERING PUMP/MOTOR

REMOVAL

1. Place keypad in **LOCK** mode.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

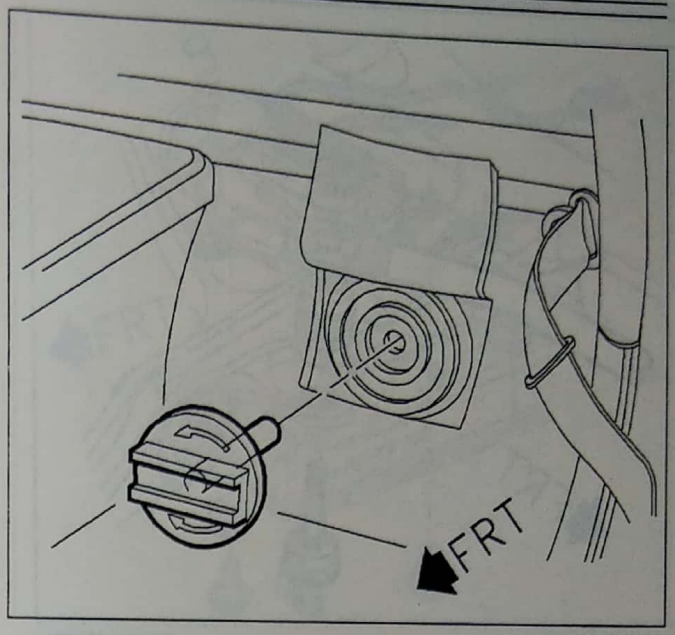
2. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)

IMPORTANT: Evacuate power steering fluid from power steering reservoir.

3. Remove electrical connector from Power Steering Control Module (PSCM).

IMPORTANT: Do not expose connector to any form of contamination.

4. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)



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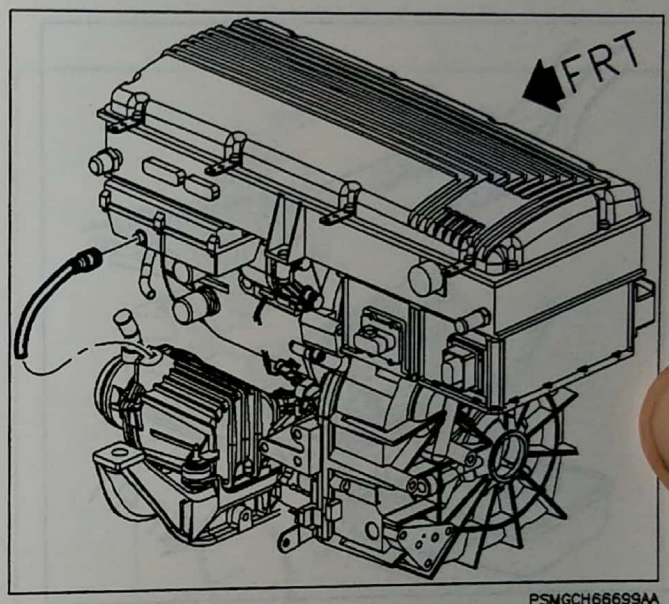

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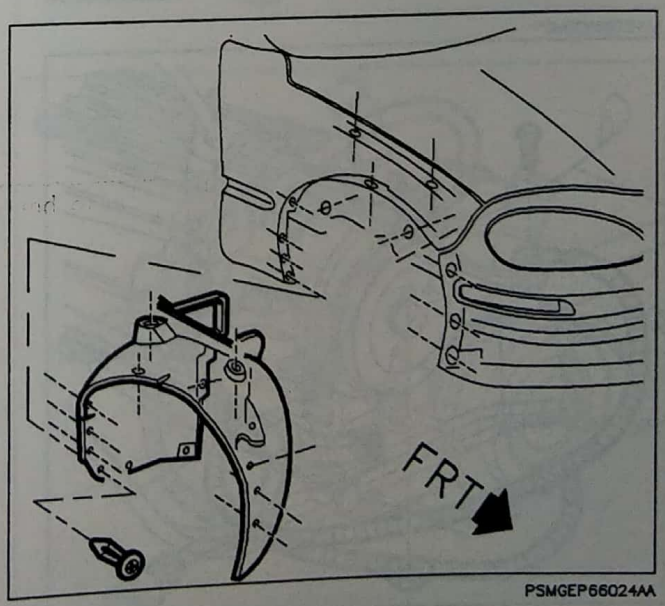
5. Remove right front wheel.
6. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)
7. Remove right side front wheel house liner.



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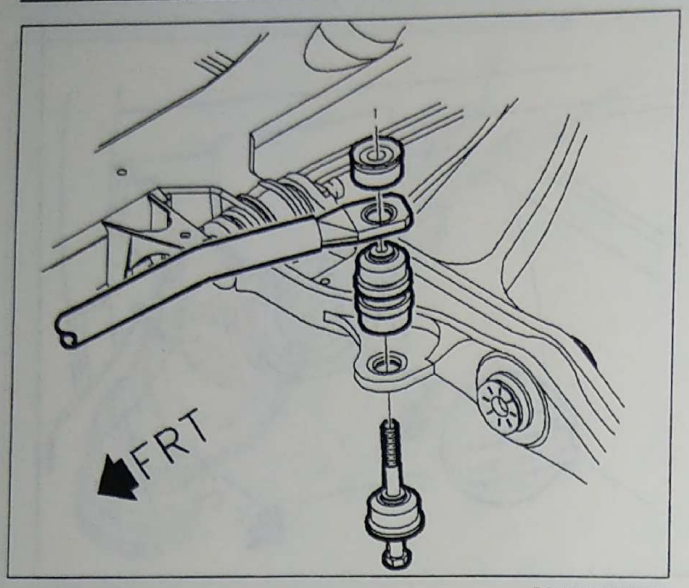

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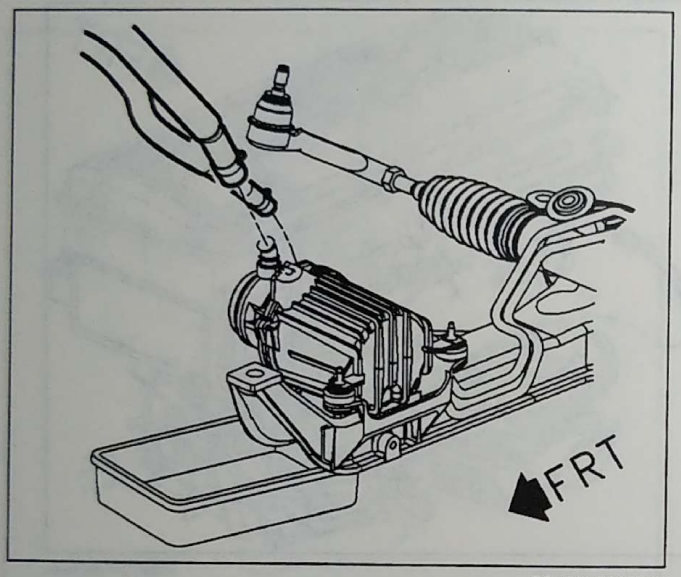
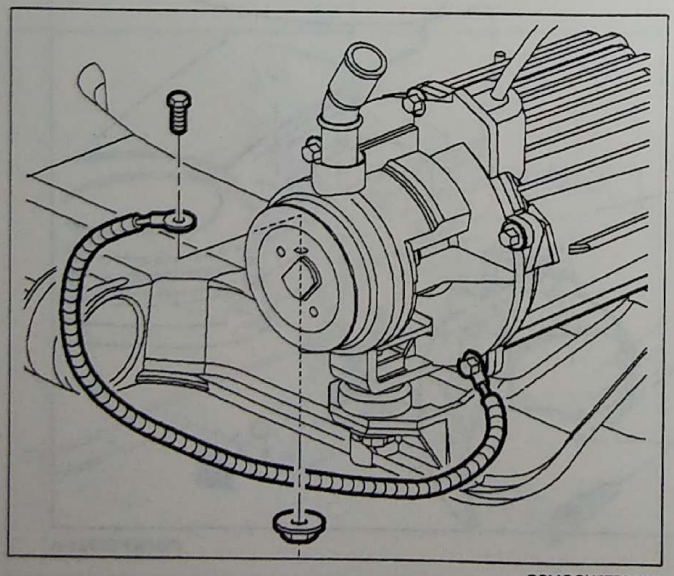
8. Disconnect stabilizer links using EV9716S Stabilizer Link Socket (or equivalent), from lower control arms, rotate sway bar out of the way.



PSMGCH66697AA

9. Place approved drain container under power steering hoses at pump/motor.



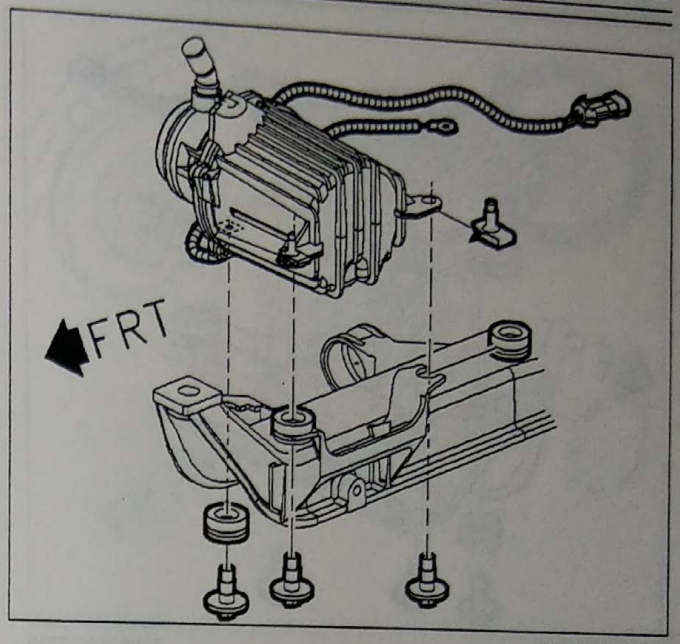
PSMGCH67705AA

10. Disconnect reservoir and high pressure lines at pump/motor. Allow power steering fluid to drain into approved container. Cap/plug pressure and reservoir lines.

11. Disconnect power steering pump/motor ground wire from cradle.

12. Disconect power steering pump/motor ground sensing harness connector.
13. Remove fasteners attaching pump/motor to cradle.
14. Remove power steering pump/motor.

IMPORTANT: The power steering pump/motor should be removed out of the right wheelwell between the drive unit cradle and the side rail.



PSMGCH65977AB

DISASSEMBLY

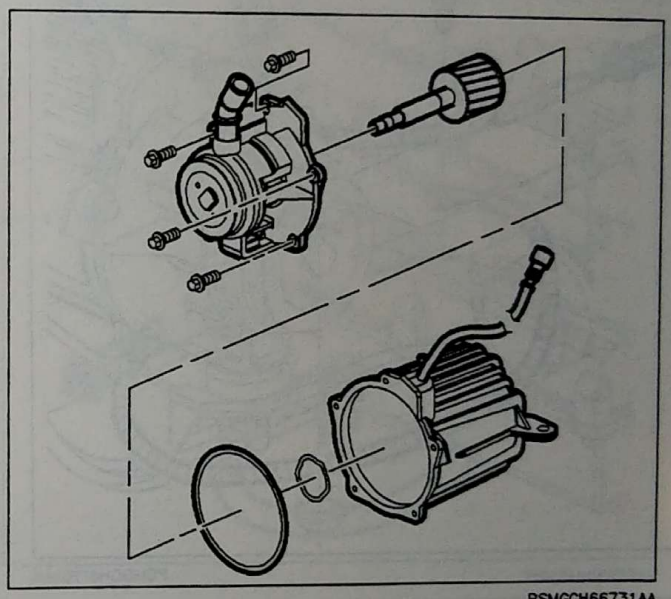
NOTICE: Power steering pump/motor parts may not be available. Check parts availablity before proceeding.

1. Remove the bolts which attach the pump to the motor housing.

NOTICE: When seperating power steering pump assembly from motor, position pump so that power steering fluid does not inner motor housing.

IMPORTANT: Motor shaft may stick in pump housing. If this occurs support motor shaft during separation. Remove motor shaft from pump housing after separation and reinstall motor shaft and wave washer into motor housing.

2. Pull the pump away from the motor, providing some twist to the housing if the upper motor bearing is not a loose fit to the pump.
3. Discard the O-ring



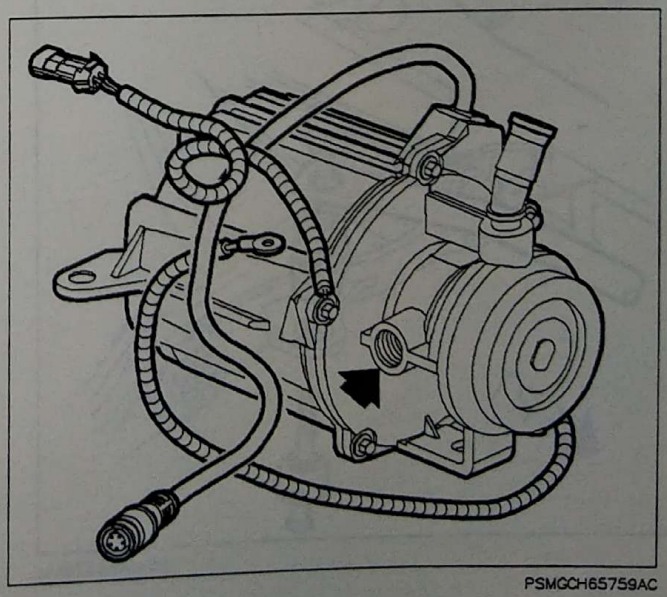
PSMGCH66731AA

ASSEMBLY

NOTICE: If replacing the motor, take extreme care to avoid scoring the drive shaft seal with the motor shaft spline. Scoring the seal may cause premature failure. Ensure that the seal is not exposed to contamination.

1. Install new, lubricated (with petroleum jelly), moisture seal O-ring around the pump housing.
2. Mount the pump onto the motor until the spline engages and the housings are firmly engaged.
3. Install ground strap and ground sensing harness wires and tighten the bolts attaching the pump to motor.

Torque: 6.0 N•m (53 in−lbs)



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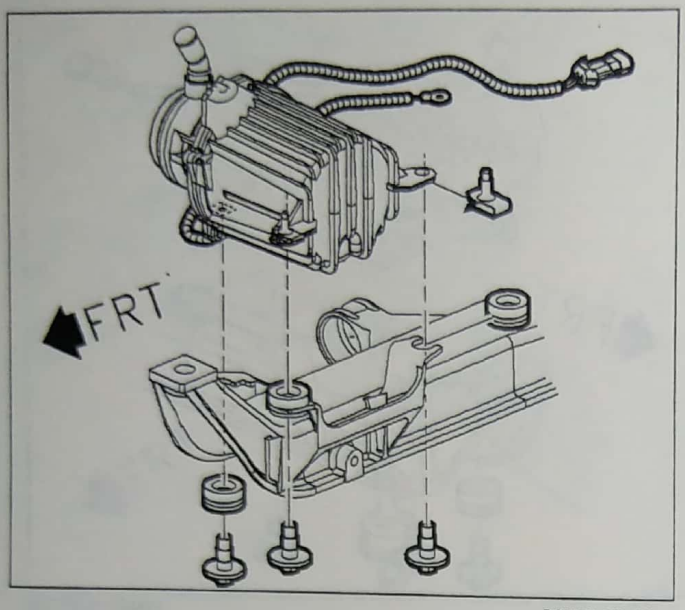

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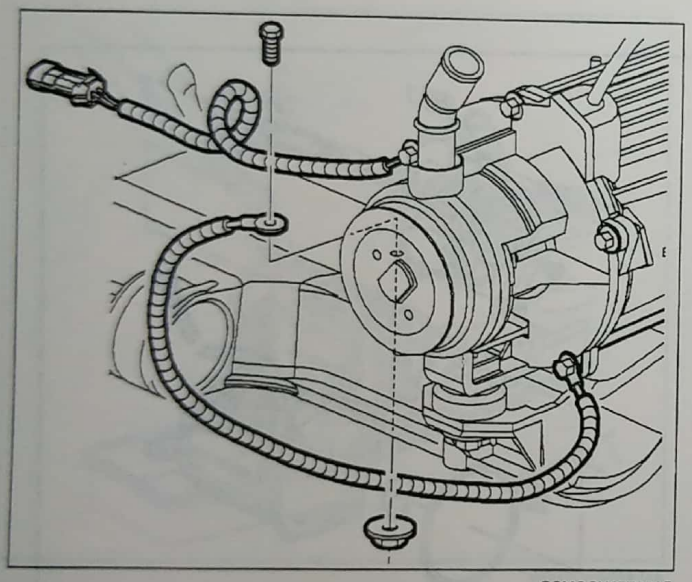

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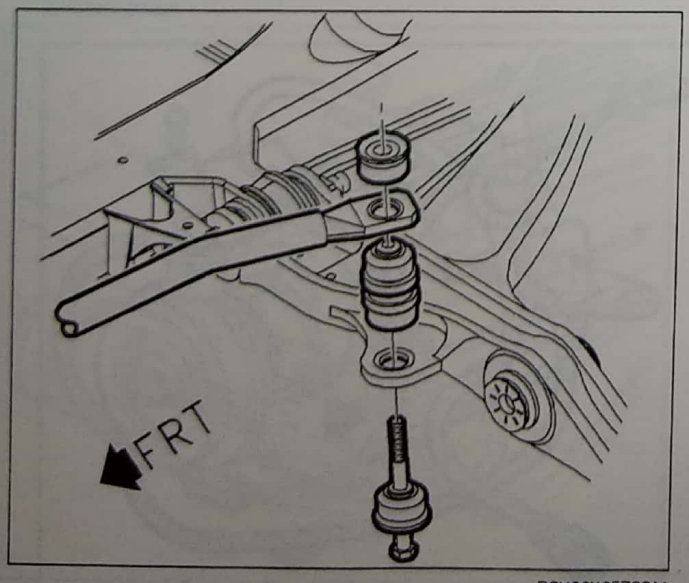


PSMGCH65788AA

INSTALLATION

1. Install power steering pump/motor.

IMPORTANT: The power steering pump/motor assembly should be installed through the right side wheelwell between the drive unit cradle and the side rail.

IMPORTANT: To ease in assembly of the power steering line into the pump, start threading the pressure fitting into the pump before the pump is tightened down.

2. Install fasteners attaching pump/motor to cradle.

IMPORTANT: Ensure the grommets are properly installed.

Torque: 6.0 N•m (53 in−lbs)

3. Connect and tighten reservoir and high pressure lines at power steering pump/motor.

Torque: 28 N•m (21 ft−lbs)

4. Connect power steering pump/motor ground wire to cradle.

Torque: 10 N•m (88.5 in−lbs)

5. Connect power steering pump/motor ground sensing harness connector.

6. Connect stabilizer links to lower control arm using EV9716S Stabilizer Link Socket (or equivalent).

Torque: 10 N•m (89 in−lbs)

7. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

   Front aeroshield fastener.

Torque: 6 N•m (53 in−lbs)

8. Install right side front wheel house liner.

   Front wheel house fastener.

Torque: 6 N•m (53 in−lbs)

9. Position wheel on hub.

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failures to do so can cause wheel lug nuts to loosen in service.

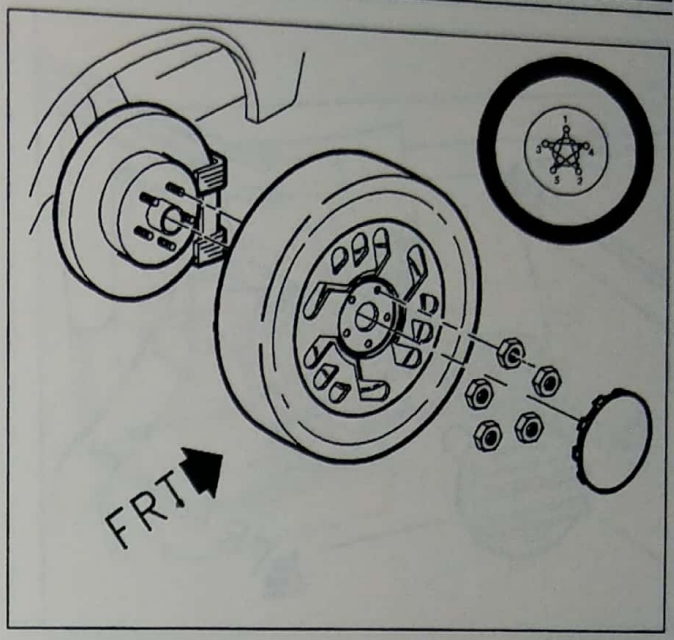
10. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

11. Lower vehicle from hoist.

12. Connect electrical connector from power steering pump/motor to power steering control modulator (PSCM).

NOTICE: Make sure connector is properly aligned to the connection at the PSCM prior to installation, this will help avoid damaging connector pin's.



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13. Fill power steering system with clean power steering fluid.

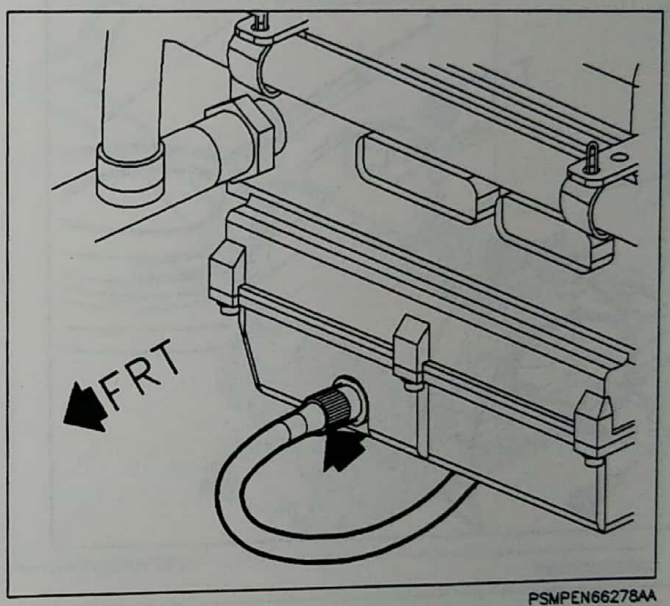
NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only p/n 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

14. Enable high voltage. (Refer to "High Voltage Enable" procedure in this manual.)

15. Power vehicle up and clear BPM codes. If the vehicle does not power-up, refer to the "High Voltage" section of this manual.

16. Bleed power steering system. (Refer to "Power Steering Bleed" procedure in this manual.)

17. Check for proper operation of power steering and also check for leaks.



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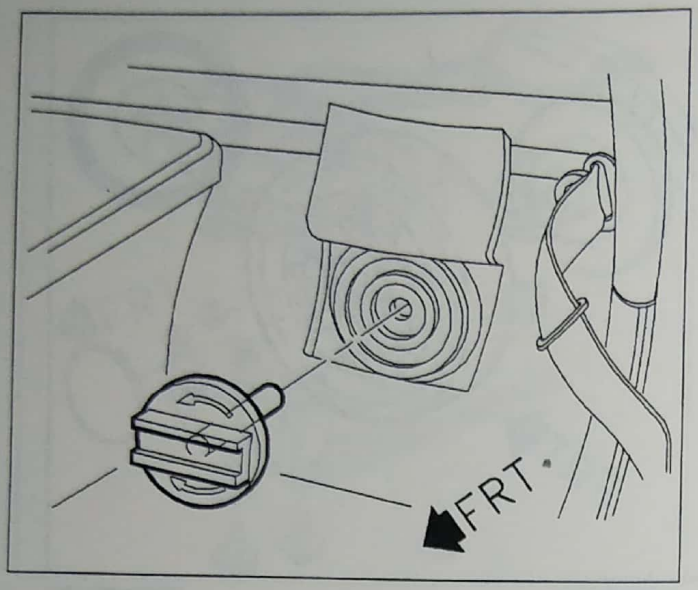
CamScanner



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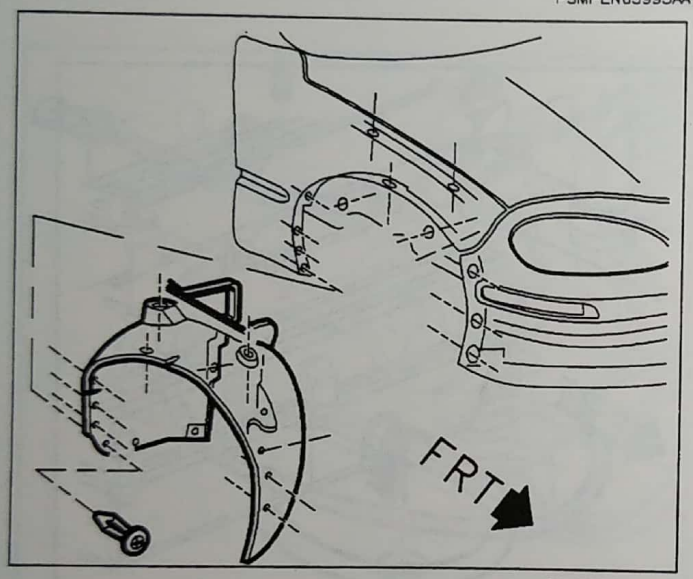

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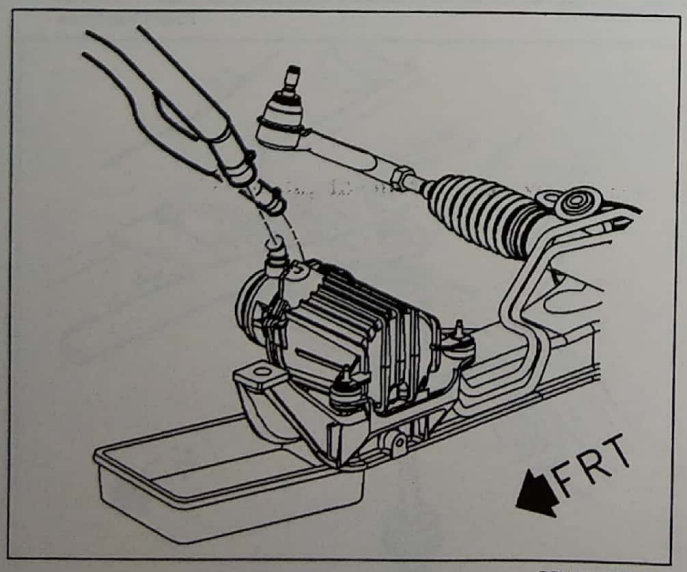

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POWER STEERING HOSE

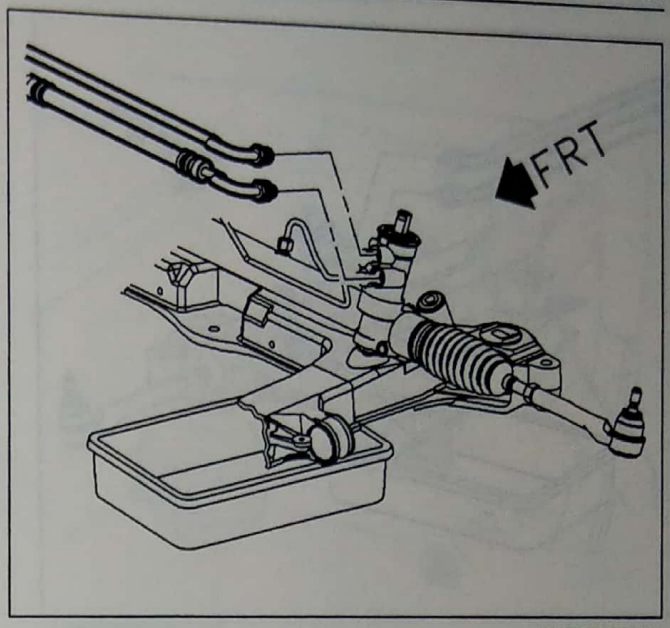
REMOVAL

1. Place keypad in **LOCK** mode.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

2. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
3. Remove power steering reservoir cap and evacuate power steering fluid from power steering reservoir.
4. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)
5. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)
6. Remove right side front wheel house liner.
7. Place approved drain container under power steering hoses either at power steering pump/motor (if removing power steering hoses from reservoir to pump/motor) or steering gear (if removing power steering hoses from pump/motor to steering gear).
8. Unclip power steering hoses.

9. Disconnect power steering hoses from either power steering pump/motor (if removing power steering hoses from reservoir to pump/motor) or from power steering gear (if removing power steering hoses from pump/motor to steering gear), and allow system to drain.



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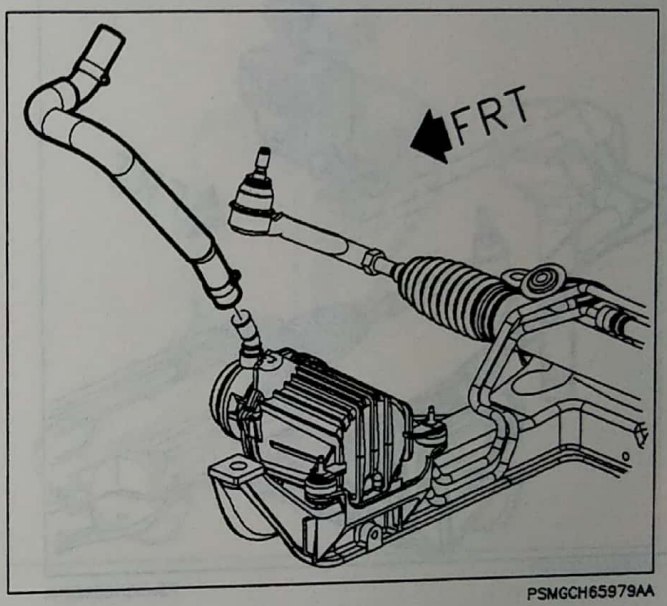
CAUTION: AFTER REMOVING POWER STEERING HOSES DO NOT ROTATE STEERING WHEEL OR PLACE KEYPAD IN "RUN" MODE, SINCE POWER STEERING FLUID MAY BE FORCED OUT OF STEERING GEAR OR PUMP/MOTOR.

10. If removing power steering hoses from pump/motor to steering rack, disconnect hoses from power steering pump/motor and remove from vehicle.
11. Lower vehicle from hoist. (If removing power steering hoses from reservoir to pump/motor).



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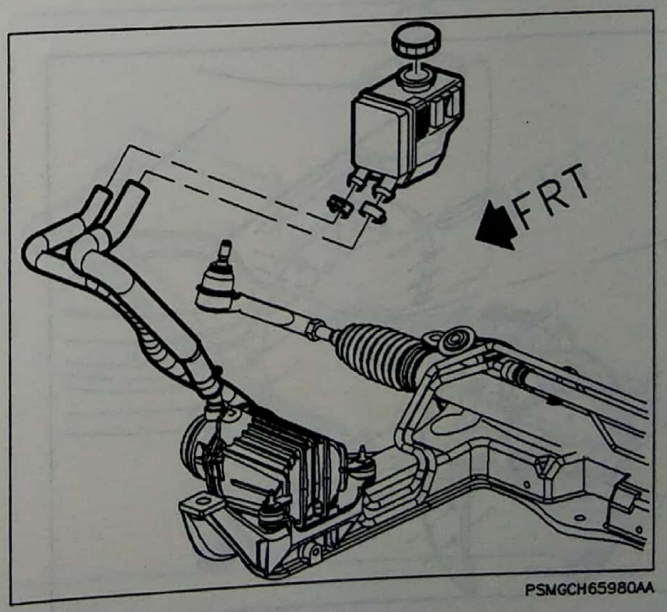
12. Disconnect power steering hoses from reservoir and remove from vehicle.



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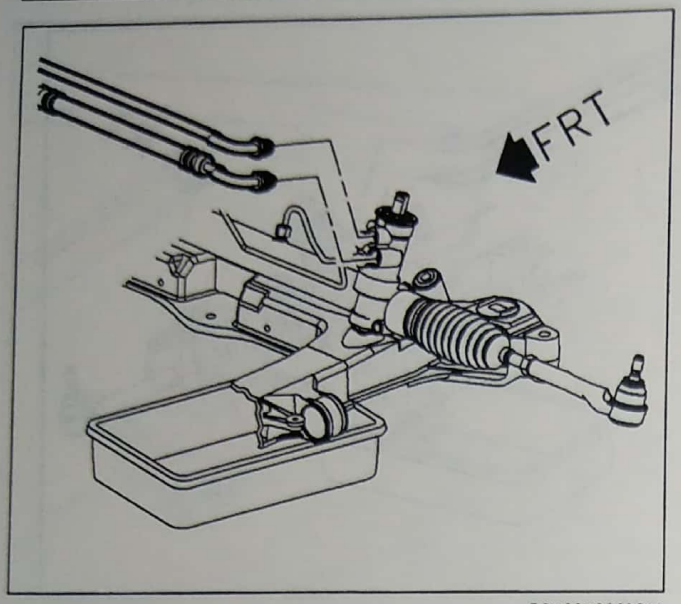

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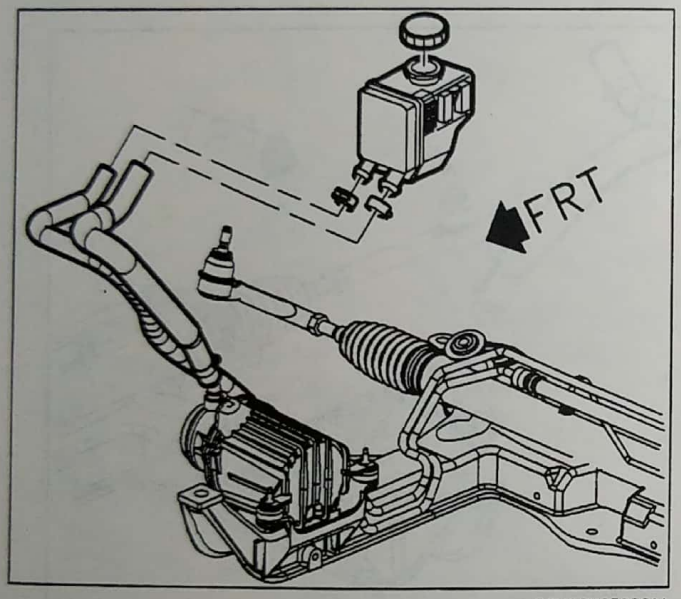

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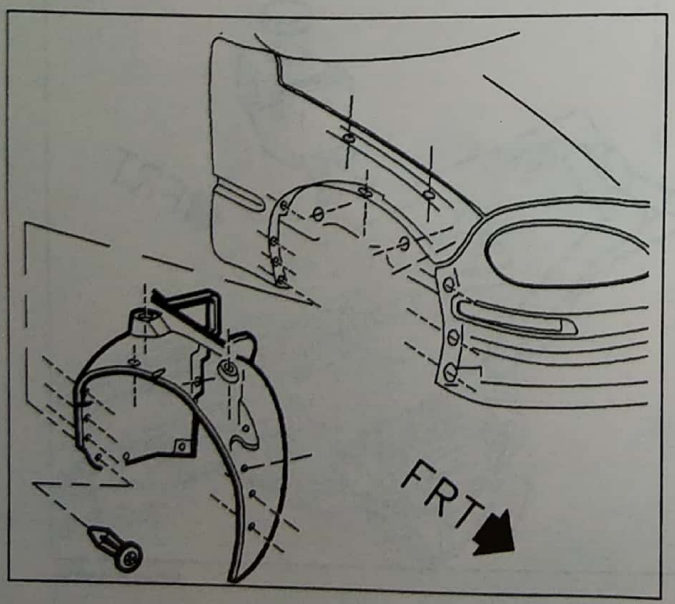

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INSTALLATION

1. Inspect O-ring seals on each end of the pressure hose and on the steering gear and replace if necessary.
2. Install power steering pressure and return hoses.
3. Tighten pressure fittings at steering gear.

Torque: 28 N•m (21 ft−lbs)

4. Tighten pressure fitting at pump/motor.

Torque: 28 N•m (21 ft−lbs)

5. Lower vehicle from hoist. (if installing power steering hose from reservoir to pump/motor, attach hose to reservoir).
6. Fill power steering reservoir with clean power steering fluid.

NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

7. Enable high voltage. (Refer to "High Voltage Enable" procedure in this manual.)
8. Bleed power steering system. (Refer to "Power Steering Bleed" procedure in this manual.)
9. Check for proper operation of power steering and also check for leaks.
10. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this manual.)
11. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" procedure in this manual.)

Torque: 6 N•m (53 in−lbs)

12. Install right side front wheel house liner.

Torque: 6 N•m (53 in−lbs)

13. Lower vehicle from hoist.

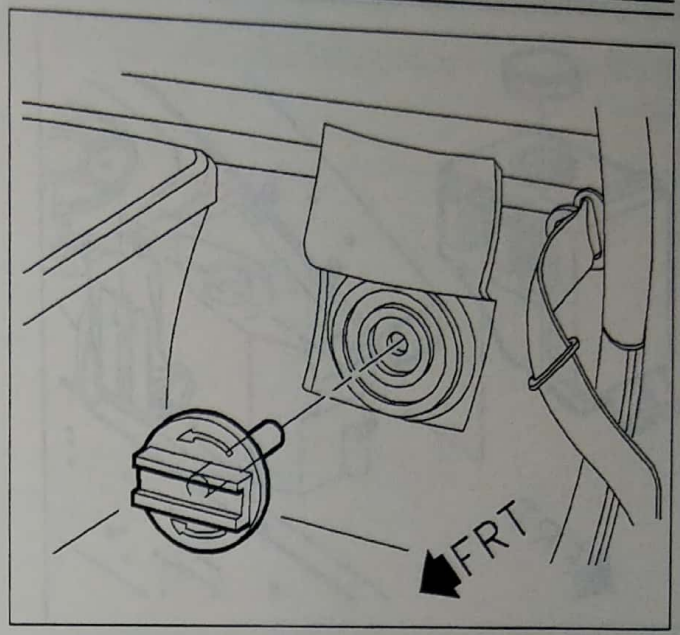
POWER STEERING PUMP RESERVOIR/BRACKET

REMOVAL

1. Place keypad in **LOCK** mode.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

2. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
3. Remove power steering reservoir cap.
4. Evacuate power steering fluid from reservoir.



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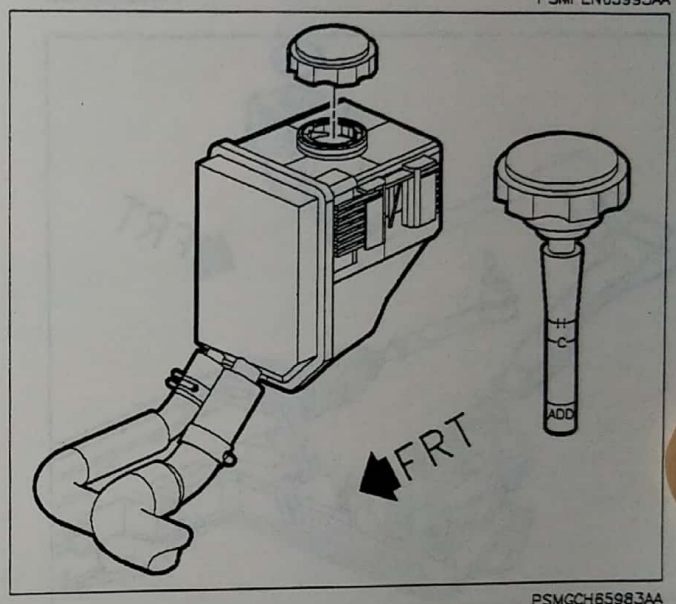

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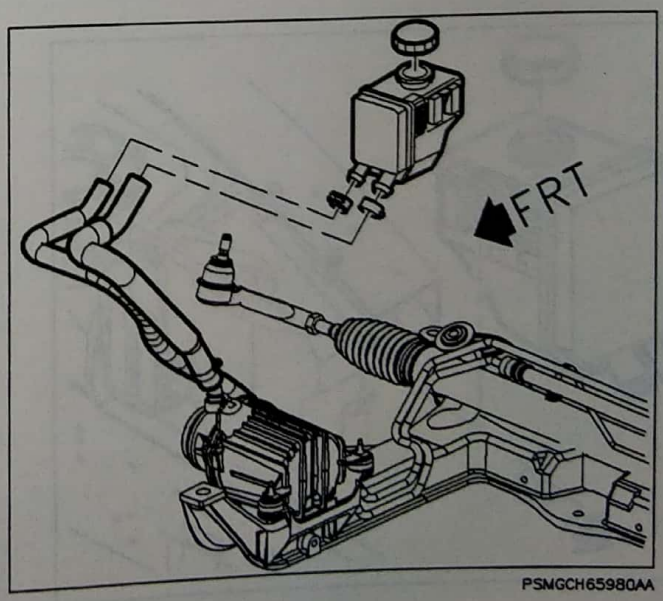
5. Disconnect hoses from reservoir.

CAUTION: AFTER REMOVING POWER STEERING HOSES DO NOT ROTATE STEERING WHEEL OR PLACE KEYPAD IN "RUN" MODE, SINCE POWER STEERING FLUID MAY BE FORCED OUT OF STEERING GEAR OR PUMP/MOTOR.



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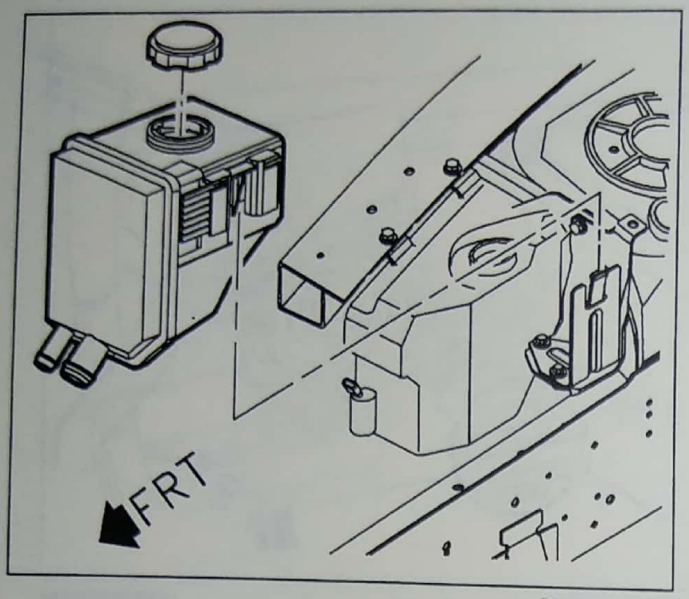

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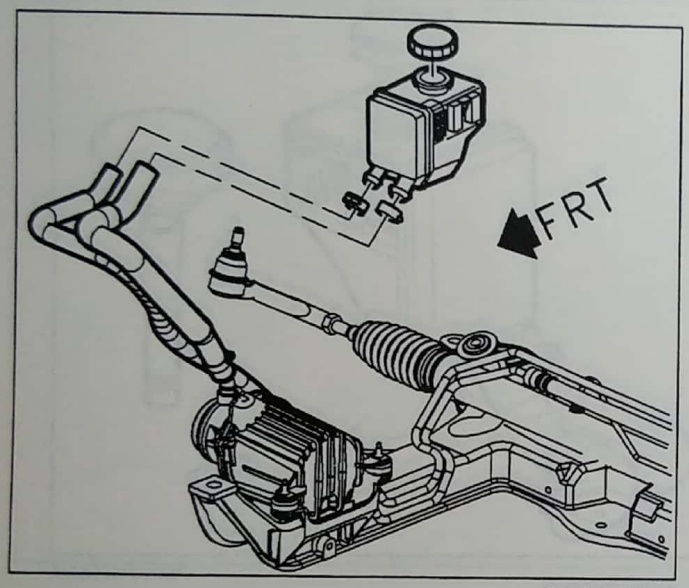
6. Remove reservoir from bracket.
7. Remove the fasteners securing bracket.
8. Remove bracket.



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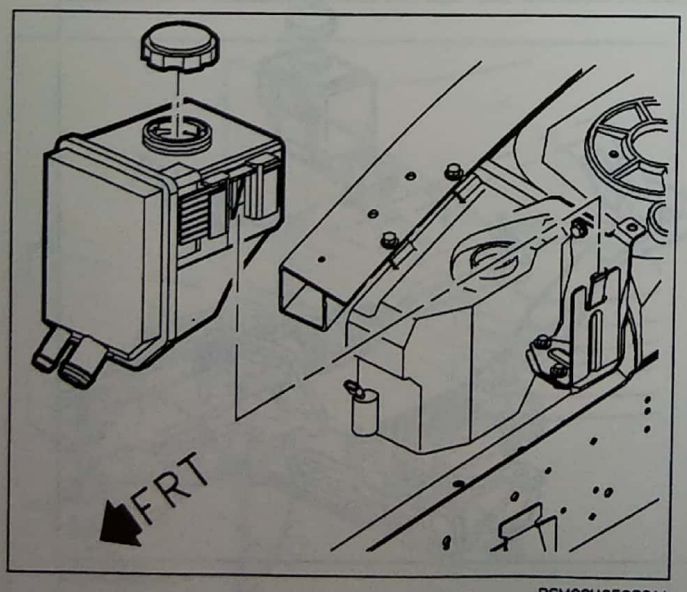
INSTALLATION

1. Install reservoir bracket.

Torque: 10 N•m (88.5 in−lbs)

2. Attach power steering hoses to reservoir.



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3. Install reservoir onto bracket.
4. Fill power steering reservoir with clean power steering fluid.

NOTICE: The EV1 uses a special electro-hydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

5. Bleed power steering system. (Refer to "Power Steering Bleed" procedure in this manual.)
6. Check for proper operation of power steering and also check for leaks.
7. Enable high voltage. (Refer to "High Voltage Enable" procedure in this manual.)

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NOTES

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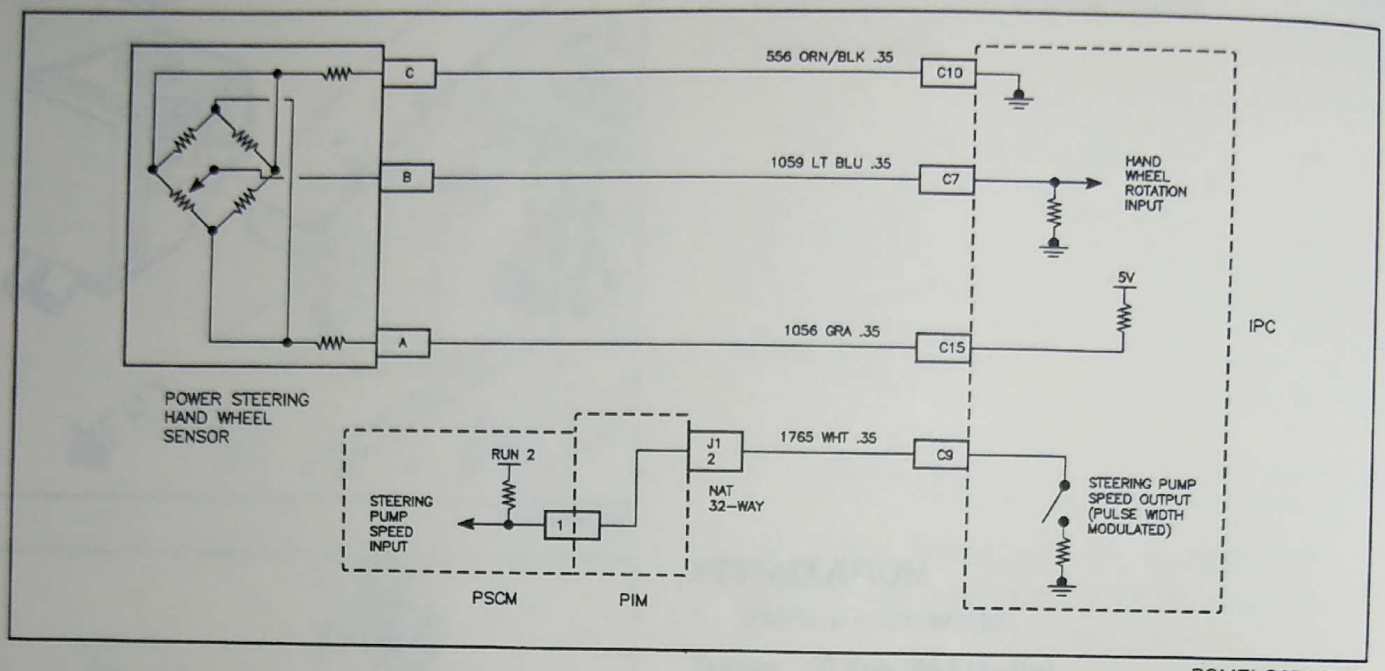
DTC 016 – HANDWHEEL SENSOR FAULT

IPC



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HANDWHEEL SENSOR FAULT

The IPC monitors the handwheel sensor feedback voltage whenever in Run mode. It uses a combination of the handwheel sensor input and vehicle speed input to calculate the steering pump speed signal, which is sent over a discreet line to the PSCM. The signal is a duty cycled output that ranges between 10% and 90%.

DTC PARAMETERS

This code will set if the handwheel sensor feedback is less than 0.25v or more than 4.75v. The current DTC will be cleared after normal sensor readings resume.

ACTION TAKEN BY THE IPC

The IPC will shift from NORMAL MODE steering operation to Fault Mode operation. In Fault Mode the steering pump control is based on vehicle speed without considering the handwheel sensor inputs per the chart below. The IPC will return to NORMAL MODE when normal handwheel sensor readings resume. Refer to IPC commanded steering pump speed for normal operation.

RELATED DTCS

None

TELLTALE ILLUMINATED:

None

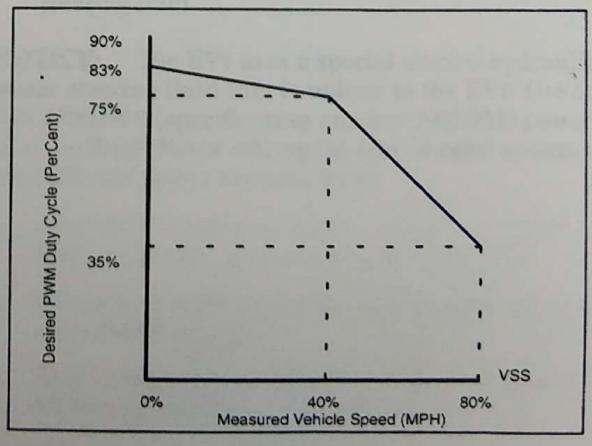
OTHER CONTROLLER INTERFACES

DIAGNOSTIC AIDS

If no handwheel feedback changes are detected for four seconds, the steering command PWM is set to 48% until an input is detected. If the charge paddle is in the charge port, the IPC PWM is set to 20%. Less than 10% and greater than 90% duty cycle from the IPC are fault levels and the PSCM defaults to 62 Hz output.

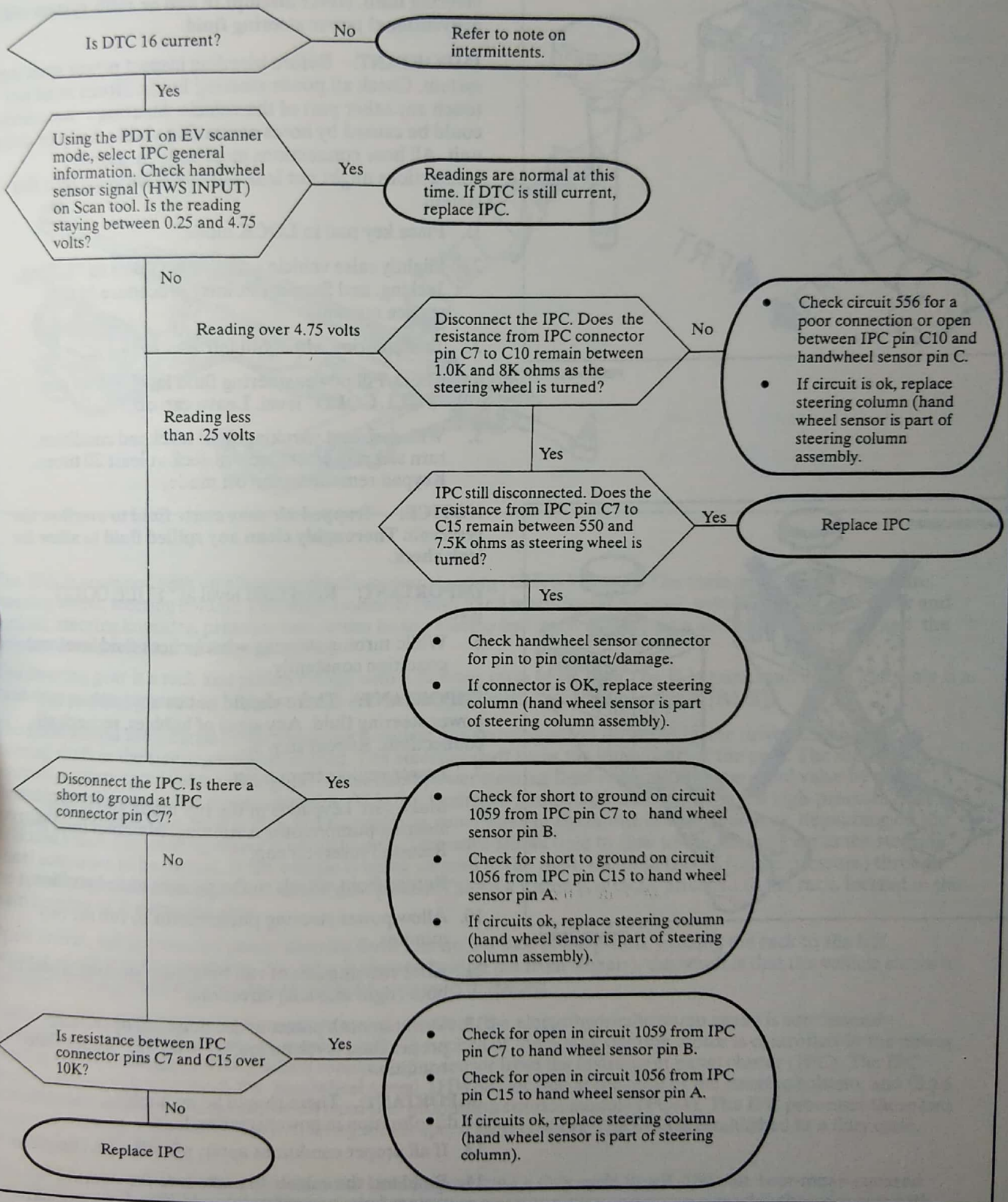
INTERMITTENTS

Try turning the wheel and manipulating connectors and wiring. If you can duplicate the condition by turning the wheel a certain way, pushing on a harness, etc., try running through the trouble tree while duplicating the condition.



Measured Vehicle Speed (MPH)
vs
Desired PWM Duty Cycle in Fault Mode.

HANDWHEEL SENSOR FAULT
DTC 16


Is DTC 16 current?
No
Refer to note on intermittents.
Yes
Using the PDT on EV scanner mode, select IPC general information. Check handwheel sensor signal (HWS INPUT) on Scan tool. Is the reading staying between 0.25 and 4.75 volts?
Yes
Readings are normal at this time. If DTC is still current, replace IPC.
No
Reading over 4.75 volts
Disconnect the IPC. Does the resistance from IPC connector pin C7 to C10 remain between 1.0K and 8K ohms as the steering wheel is turned?
No
• Check circuit 556 for a poor connection or open between IPC pin C10 and handwheel sensor pin C.
• If circuit is ok, replace steering column (hand wheel sensor is part of steering column assembly.
Reading less than .25 volts
Yes
IPC still disconnected. Does the resistance from IPC pin C7 to C15 remain between 550 and 7.5K ohms as steering wheel is turned?
Yes
Replace IPC
Yes
• Check handwheel sensor connector for pin to pin contact/damage.
• If connector is OK, replace steering column (hand wheel sensor is part of steering column assembly).
Disconnect the IPC. Is there a short to ground at IPC connector pin C7?
Yes
• Check for short to ground on circuit 1059 from IPC pin C7 to hand wheel sensor pin B.
• Check for short to ground on circuit 1056 from IPC pin C15 to hand wheel sensor pin A.
• If circuits ok, replace steering column (hand wheel sensor is part of steering column assembly).
No
Is resistance between IPC connector pins C7 and C15 over 10K?
Yes
• Check for open in circuit 1059 from IPC pin C7 to hand wheel sensor pin B.
• Check for open in circuit 1056 from IPC pin C15 to hand wheel sensor pin A.
• If circuits ok, replace steering column (hand wheel sensor is part of steering column).
No
Replace IPC

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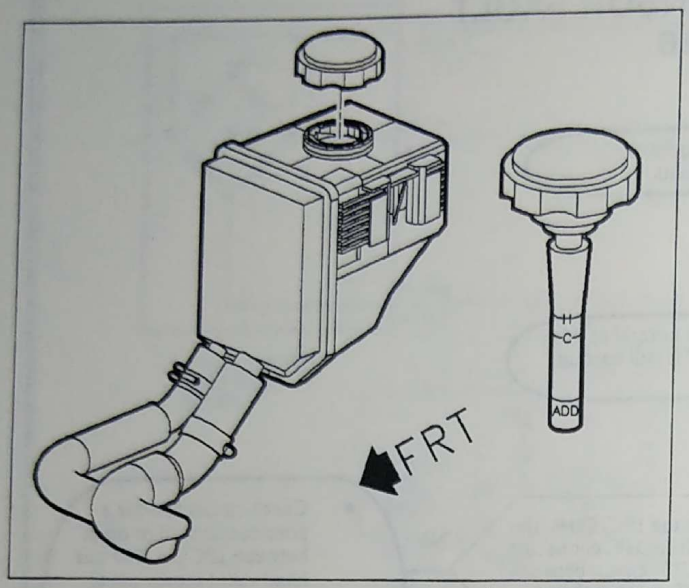
POWER STEERING SYSTEM BLEED PROCEDURE



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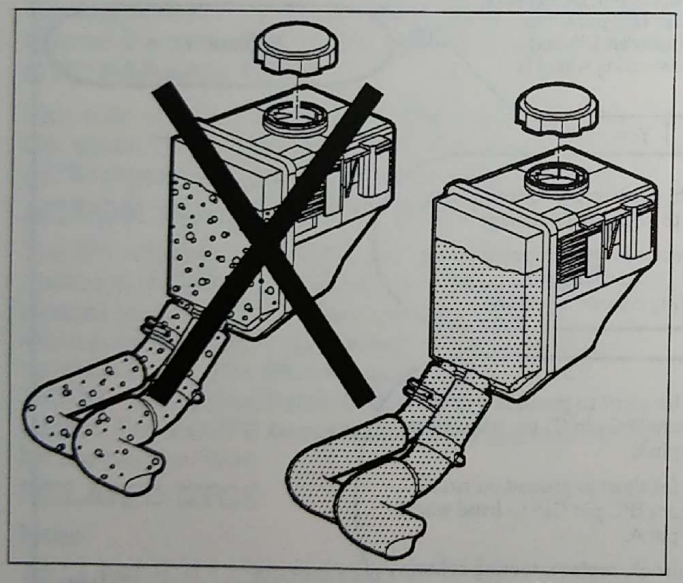

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NOTICE: The EV1 uses a special electrohydraulic power steering fluid that is unique to the EV1. Use only P/N 27002509 (specification number 9985931) power steering fluid. Never attempt to add or refill system with conventional power steering fluid.

IMPORTANT: Before bleeding inspect power steering system. Check all power steering hoses. Hoses must not touch any other part of the vehicle. Steering system noise could be caused by hoses contacting cradle, body or drive unit. All hose connections must be tight. Loose connections might not leak but could allow air into the system.

1. Place key pad in **LOCK** mode.
2. Slightly raise vehicle on a hoist. (Refer to "Lifting, Jacking, and Support Points" procedure in this service manual).
3. Turn steering wheel full left.
4. Check/Fill power steering fluid level. Fill to the "FULL COLD" level. Leave cap off.
5. With assistant checking fluid level and condition, turn steering wheel lock-to-lock at least 20 times. Keypad remains in the off mode.

NOTICE: Trapped air may cause fluid to overflow the reservoir. Thoroughly clean any spilled fluid to allow for leak check.

IMPORTANT: Keep fluid level at "FULL COLD" level.

6. While turning steering wheel, check fluid level and condition constantly.

IMPORTANT: There should not be any bubbles in power steering fluid. Any signs of bubbles, recheck all connections. Repeat step 5.

7. Lower vehicle from hoist.
8. Make sure keypad is in the run mode and power steering pump/motor is running. Maintain fluid level. Reinstall reservoir cap.
9. Return front wheels to the straight ahead position.
10. Allow power steering pump/motor to run for two minutes.
11. After two minutes of run time, turn steering wheel in both (right and left) directions.
12. Verify smooth power assist, noiseless operation, proper fluid level, no system leaks and proper fluid condition.

IMPORTANT: There should be no bubbles, no foam, no discoloration in power steering fluid.

13. If all proper conditions apply, procedure is complete.
14. Road test the vehicle to make sure the steering system functions normally and is free from unusual noises.

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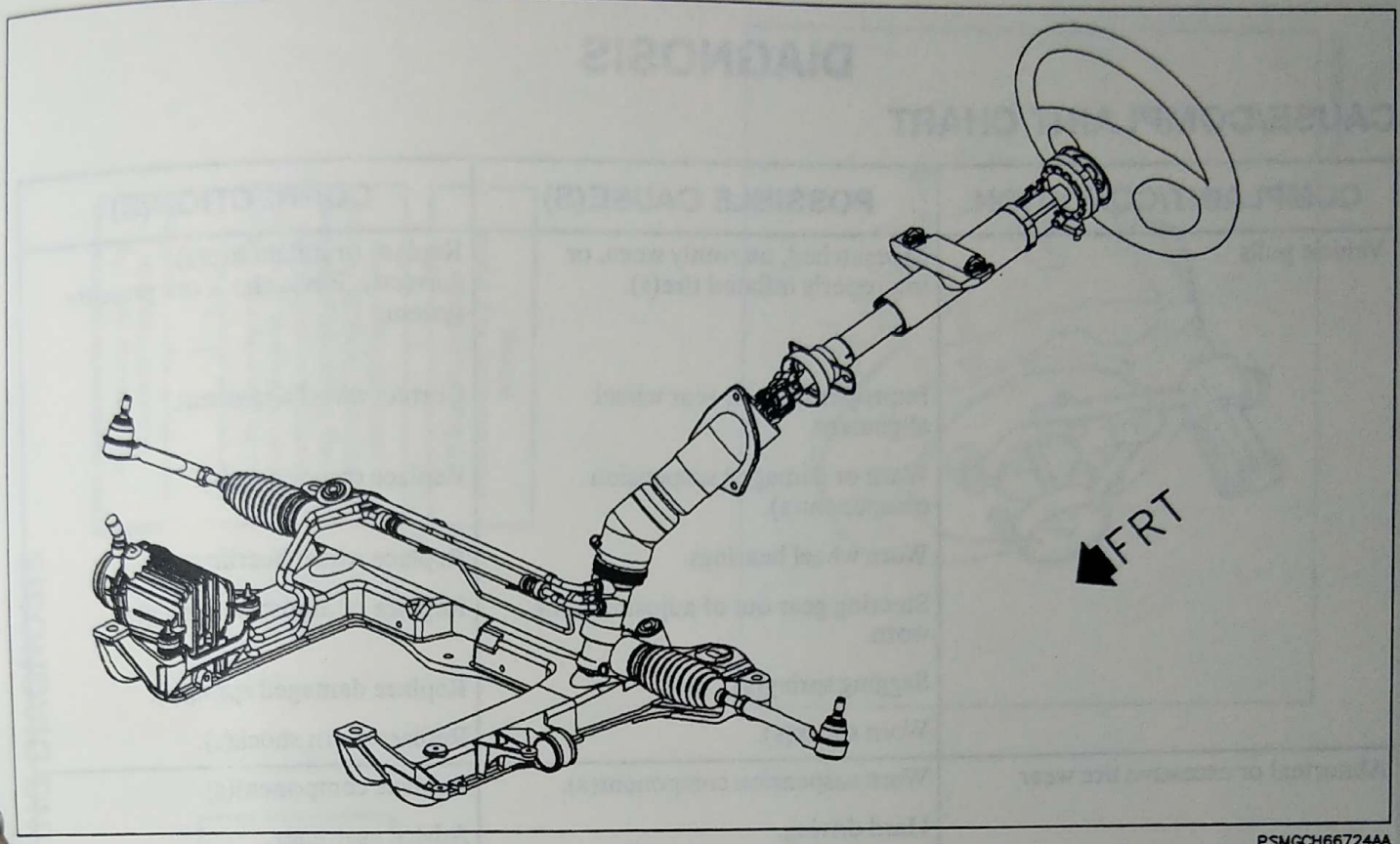
GENERAL DESCRIPTION



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The EV1 is equipped with an electrohydraulic power steering (EHPS) system. The main parts of the system are, steering wheel, steering column and shaft assembly (with hand wheel speed sensor), power steering gear (rack and pinion), steering knuckles, pressure and return hoses, electro-hydraulic (E-H) pump and motor assembly, and the power steering reservoir and cap assembly.

The steering gear is a rack and pinion design with a steering ratio of 16.38:1. The E-H pump and motor assembly is a vane-type pump, powered by a high-voltage AC motor (180 volts, root-mean-squared, [RMS]).

The front wheels are steered in the following manner: the steering wheel is turned by the driver, causing the steering shaft in the steering column to turn. The steering shaft turns the input shaft of the gear. The input shaft controls a rotary spool valve in the gear. Pressurized power steering fluid is supplied to the spool valve by the electrohydraulic pump and motor assembly. This fluid exits the pump and travels through the high-pressure hose to the inlet of the gear. The fluid is directed through the spool valve in either one of two directions, depending on the direction which the steering wheel is being turned. The valve allows fluid to flow to the gear as long as the steering wheel continues to be turned. If the vehicle is being steered to the right, the fluid travels (under pressure) through the spool valve and to the right side of the rack piston. The rack piston is directly attached to the rack, located in the main housing of the steering gear.

Upon arrival, the pressurized power steering fluid acts on the face of the piston, pushing the rack to the left. Because of the steering geometry (the gear is located behind the front wheels), the result is that the vehicle steers to the right. The opposite occurs when the vehicle is steered to the left.

Unlike a conventional constant-flow power steering system, the electrohydraulic pump speed is continuously variable, independent of propulsion motor speed. The speed of the power steering motor is controlled by the power steering control module (PSCM), which receives input sensor from the instrument panel cluster (IPC). The IPC receives two signals: (1.) from the handwheel speed (HWSS) located at the base of the steering column, and (2.) a vehicle speed signal (VSS) directly wired from the propulsion control module (PCM). The IPC processes these two signals and converts them to a power steering motor speed signal (MSS). The MSS is established as a duty cycle, ranging from 0 to 100 %.

The PSCM converts the power steering motor speed signal from a duty cycle to a 0 -180 volt root-mean-squared (RMS), three-phase AC waveform. The speed of the power steering motor and pump assembly then changes with the voltage value of the input signal.

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FRONT SUSPENSION

DIAGNOSIS

CAUSE/COMPLAINT CHART

COMPLAINT/CONDITION	POSSIBLE CAUSE(S)	CORRECTION(S)
Vehicle pulls	Mismatched, unevenly worn, or improperly inflated tire(s).	Replace or inflate tire(s) correctly. Reset check tire pressure system.
	Improper front or rear wheel alignment.	Correct wheel alignment.
	Worn or damaged suspension component(s).	Replace component(s).
	Worn wheel bearings.	Replace wheel bearings.
	Steering gear out of adjustment or worn.	Replace or adjust steering gear.
	Sagging spring(s).	Replace damaged spring(s).
	Worn shock(s).	Replace worn shock(s).
Abnormal or excessive tire wear	Worn suspension component(s).	Replace component(s).
	Hard driving.	Advice customer.
	Tire(s) improperly inflated.	Inflate tire(s) correctly. Reset check tire pressure system.
	Worn shock(s).	Replace worn shock(s).
Excessive body roll/pitching	Stabilizer link bent or broken.	Replace stabilizer bar/stabilizer bar links.
	Broken or sagging spring(s).	Replace damaged spring(s).
	Tire(s) improperly inflated.	Inflate tire(s) correctly. Reset check tire pressure system.
	Shock(s) worn.	Replace worn shock(s).
Suspension bottoming	Broken or sagging spring(s).	Replace damaged spring(s).
	Shock(s) worn.	Replace worn shock(s).
Front wheel shimmy	Tire(s) worn, out of round, or improperly inflated.	Replace or inflate tire(s) correctly. Reset check tire pressure system.
	Wheel(s) out of balance.	Balance wheel(s).
	Worn shock(s).	Replace worn shock(s).
	Wheel bearing(s) worn.	Replace worn bearing(s).
	Ball stud(s) worn.	Replace worn ball stud(s).
	Lower control arm bushing(s) worn or damaged.	Replace lower control arm(s) and/or bushing.
	Stabilizer bushing(s) worn or damaged.	Replace worn or damaged bushing(s).

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SEALED WHEEL BEARING DIAGNOSIS

Wheel Bearing Assembly Noise Diagnosis

If a Road Test indicates noise, it could be wheels, bearings, or tires; check the following.

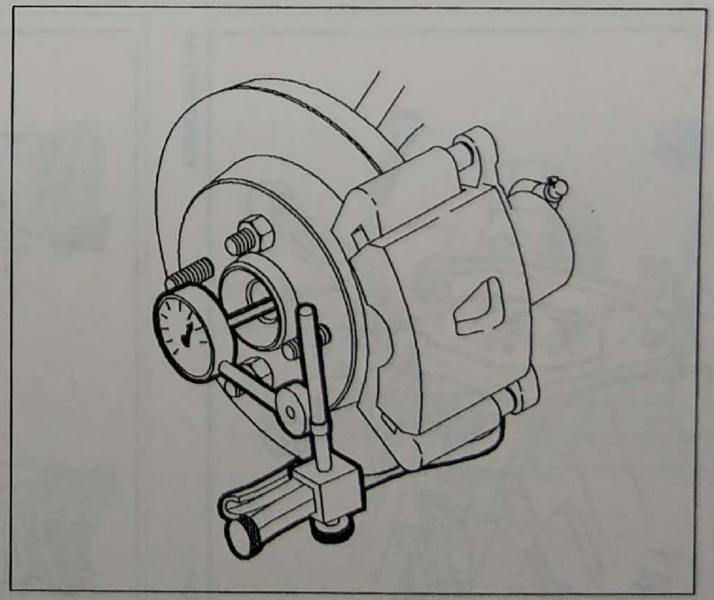
1. Check tires for proper pressure and uneven wear. Reset check tire pressure system.
2. Raise vehicle on a hoist and spin wheels; check for out−of−round tires, out−of−balance tires, bent rims, loose wheel nuts, loose and/or rough wheel bearings.

- Suspect bearing noise.
  - Front wheel bearing assembly.
  - Hoist vehicle and support lower control arm and spin wheel with drive unit.
  - **CAUTION: ON FRONT WHEEL DRIVE VEHICLES WHEEL SPIN SHOULD BE LIMITED TO 56 km/h (35 mph) AS INDICATED ON THE SPEEDOMETER. THIS LIMIT IS NECESSARY BECAUSE THE SPEEDOMETER ONLY INDICATES ONE−HALF OF THE ACTUAL WHEEL SPEED WHEN ONE DRIVE WHEEL IS SPINNING AND THE OTHER DRIVE WHEEL IS STOPPED. UNLESS CARE IS TAKEN IN LIMITING DRIVE WHEEL SPIN, THE SPINNING WHEEL CAN REACH EXCESSIVE SPEEDS. THIS CAN RESULT IN POSSIBLE TIRE DISINTEGRATION OR DIFFERENTIAL FAILURE, WHICH COULD CAUSE SERIOUS PERSONAL INJURY OR EXTENSIVE VEHICLE DAMAGE.**
    - Noise or roughness can be heard from driver seat.
      - Replace bearing assembly.
    - Noise or roughness cannot be heard
      - Noise is not wheel bearing assembly.
- Other noise. (Correct as required)

Wheel Bearing Assembly Looseness Diagnosis

Free the shoes from the disc or remove the calipers. Install two wheel nuts to secure disc to bearing. Mount dial indicator as shown below. Grasp disc and use a push−pull movement.

If looseness exceeds 0.130 mm (0.005 in.), replace bearing.



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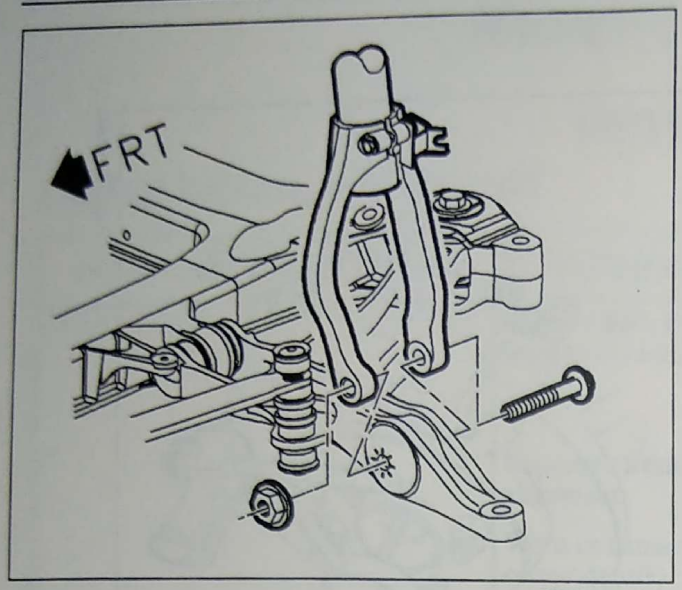

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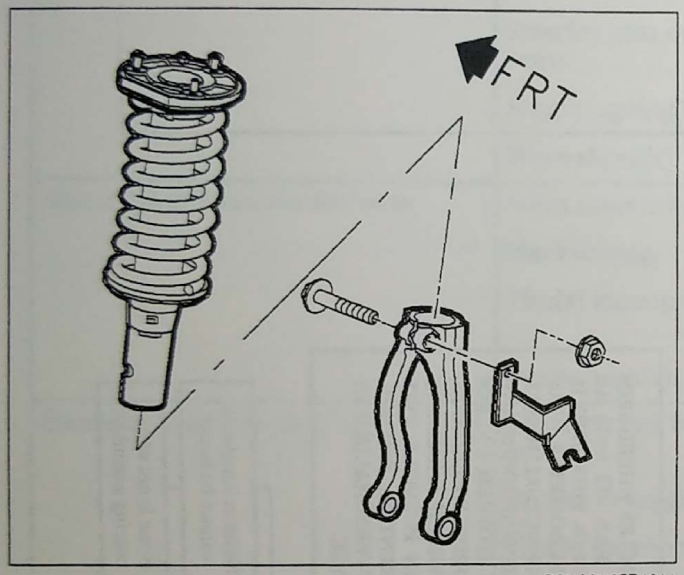
FRONT SHOCK ABSORBER/YOKE

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Remove road wheel.

IMPORTANT: Support lower control arm



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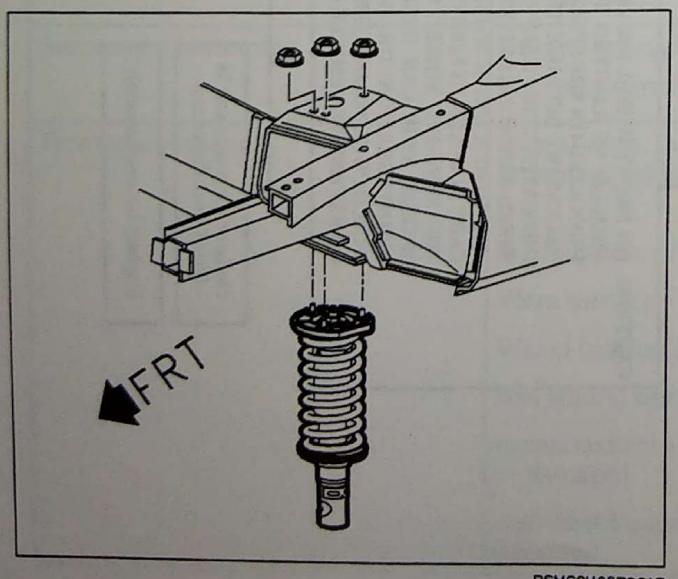
3. Disconnect yoke from lower control arm and disconnect wire from bracket attached to yoke.
4. Remove yoke to shock absorber pinch bolt and bracket.

NOTICE: Before removing shock assembly, place a rag over the CV joint seal to protect it from damage.

5. Allow yoke to slide down over axle shaft.
6. Remove and discard the three shock assembly-to-body attachment nuts.



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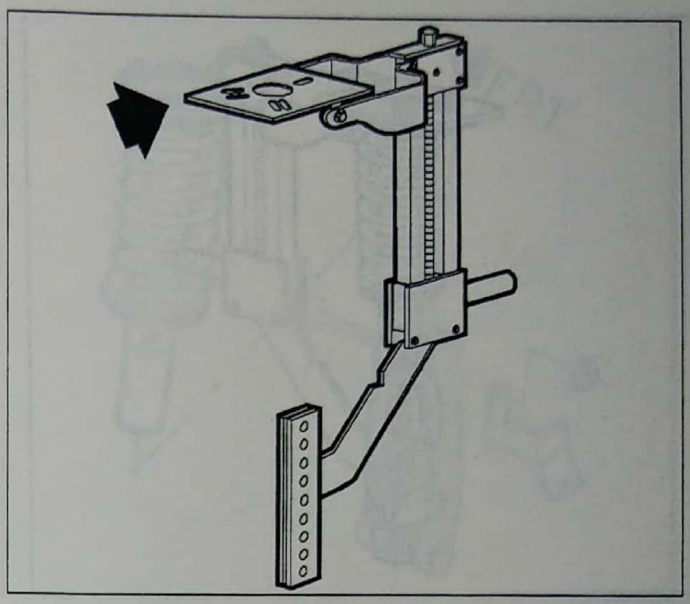
7. Remove shock absorber assembly and yoke from vehicle.

DISASSEMBLY

CAUTION: COIL OVER SHOCK SPRING IS UNDER A HIGH COMPRESSIVE LOAD. DO NOT REMOVE THE SHOCK SHAFT TO UPPER SUPPORT NUT WITHOUT FIRST UNLOADING THE UPPER AND LOWER SPRING SUPPORTS OF SPRING PRESSURE, USING THE PROPER SPRING COMPRESSING TOOL.

1. Mount shock spring compressor tool (SA9155S or equivalent) in holding fixture.
2. Set spring compressor top plate to the up position (referance illustration) and secure pivot bolts.



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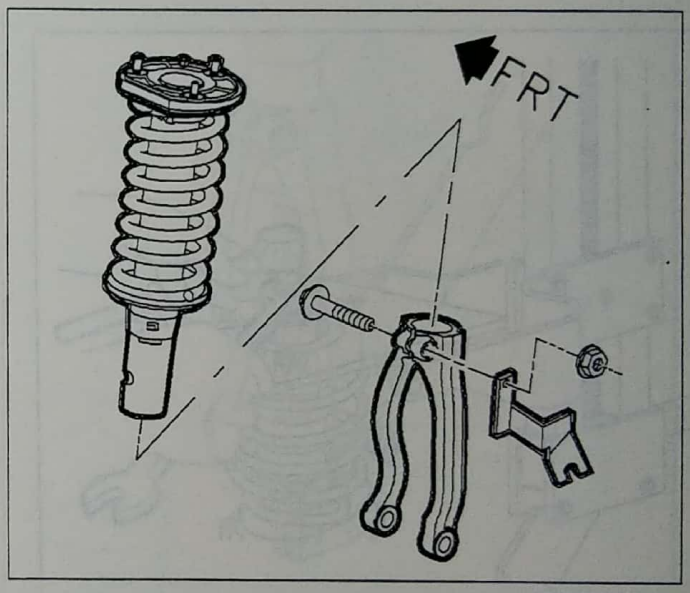
3. Place the coil-over-shock without yoke assembly into spring compressor. Attach the upper shock mount to spring compressor top using the three shock-to-body attachment nuts.

IMPORTANT: Install mount with flat side of upper shock mount facing ouward from spring compressor and aligned with indentation in shock absorber.

Torque: 23 N•m (17 ft−lbs)



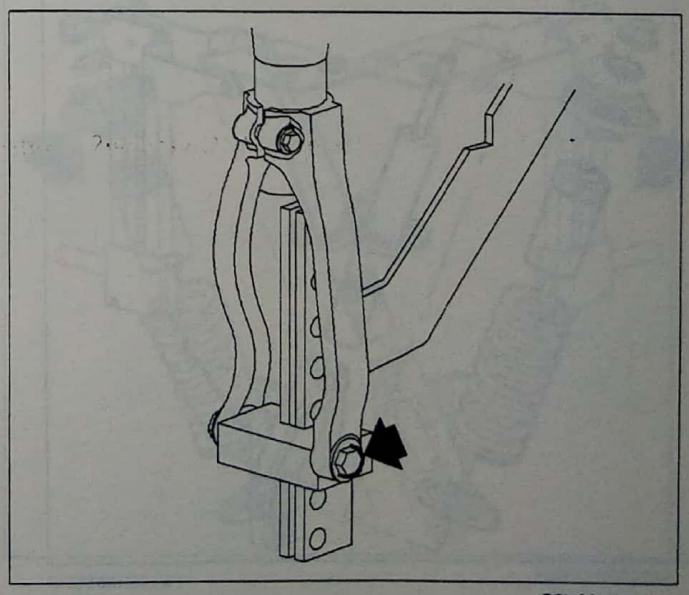
PSMGCH65742AA

4. Slide yoke onto coil over shock.
5. Align pinch bolt thru hole to incentation in shock absorber assembly.
6. Install pinch bolt.

IMPORTANT: Install yoke to shock absorber pinch bolt with head of bolt towards the front of vehicle.

Torque: 35 N•m (26 ft−lbs)

7. Using the third hole from the bottom, fasten lower portion of yoke to the spring compressor using adaptor (EV9709S or equivalent).



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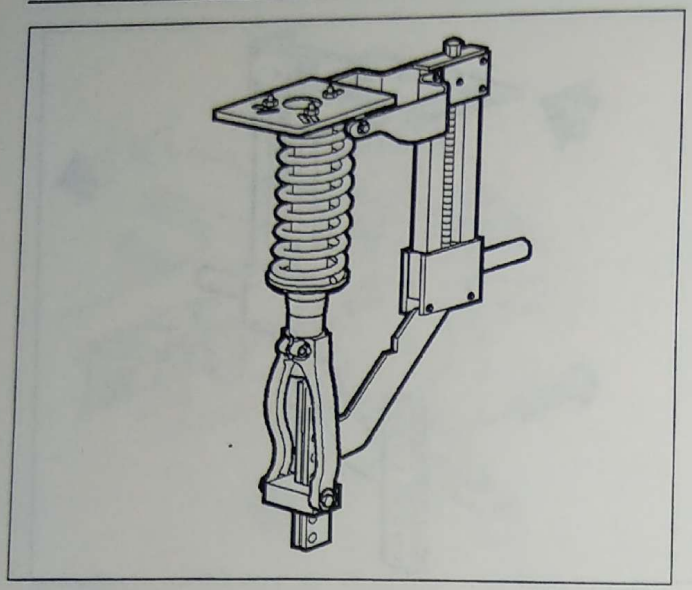
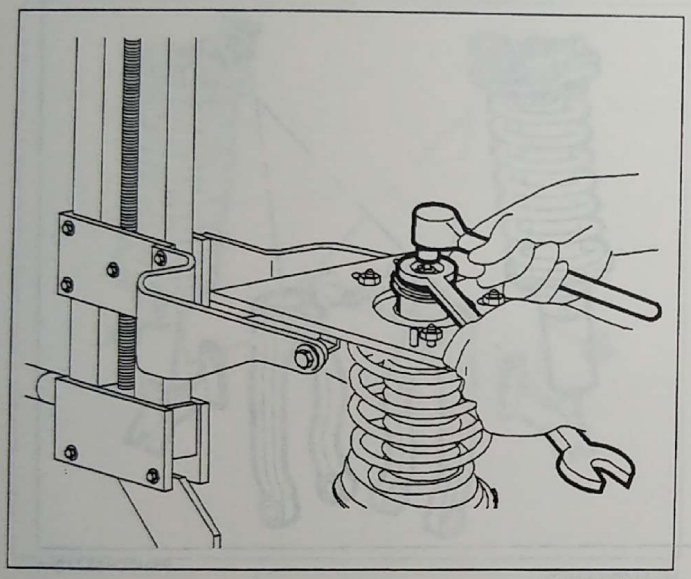


PSMGCH66105AC

8. Compress spring enough to completely unload the upper coil-over-shock mount.

NOTICE: Follow spring compressor manufacturers instructions.

9. Remove the shock absorber shaft nut, while holding the shock absorber shaft stationary with a HEX™ socket wrench.



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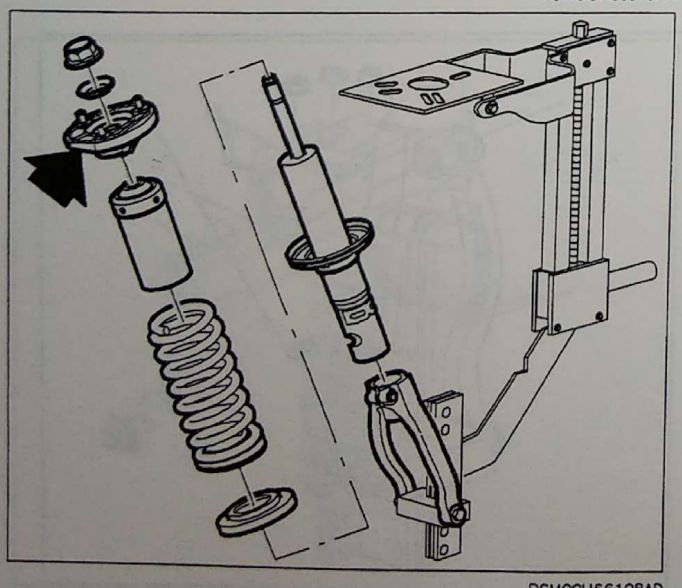
10. Release spring compressor fulley and tilt coil-over-shock assembly outward.
11. Remove upper coil-over-shock mount assembly. Inspect rubber for cracks or deterioration.

IMPORTANT: If necessary, tilt spring compressor top plate upwards to aid in removal of upper coil-over-shock mount.

12. Remove spring and insulator from shock absorber. Inspect spring and insulator for damage.
13. Remove dust shield assembly. Inspect for cracks or deterioration.
14. Remove shock absorber from compressor. Extend and retract shock absorber shaft and check for smooth, even resistance and for signs of a fluid leak.
15. Disconnect yoke from shock absorber assembly.



PSMGCH66108AD

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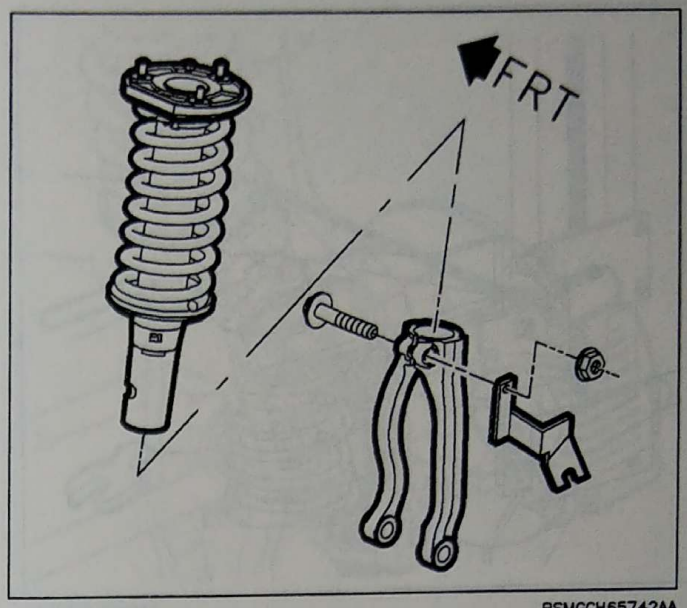
ASSEMBLY

1. Attach shock absorber to yoke.

NOTICE: Install yoke to shock absorber assembly, aligning pinch bolt thru hole to indentation in shock absorber assembly.

IMPORTANT: Install yoke to shock absorber pinch bolt and bracket with head of bolt towards the front of vehicle.

Torque: 35 N•m (26 ft−lbs)

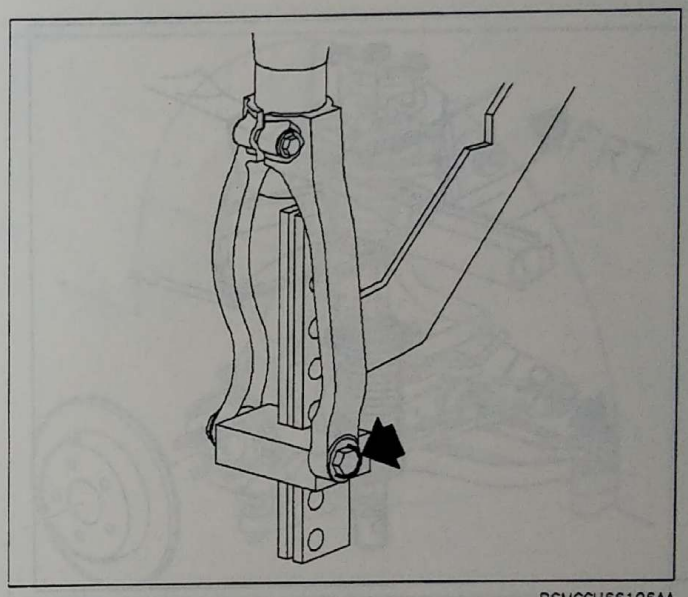


PSMGCH65742AA

2. Using the third hole from the bottom, fasten lower portion of yoke to the spring compressor using adaptor (EV9709S or equivalent).

IMPORTANT: Hold shock absorber, while tightening fastener

3. Extend the shock absorber shaft to the limit of its travel.



PSMGCH66106AA

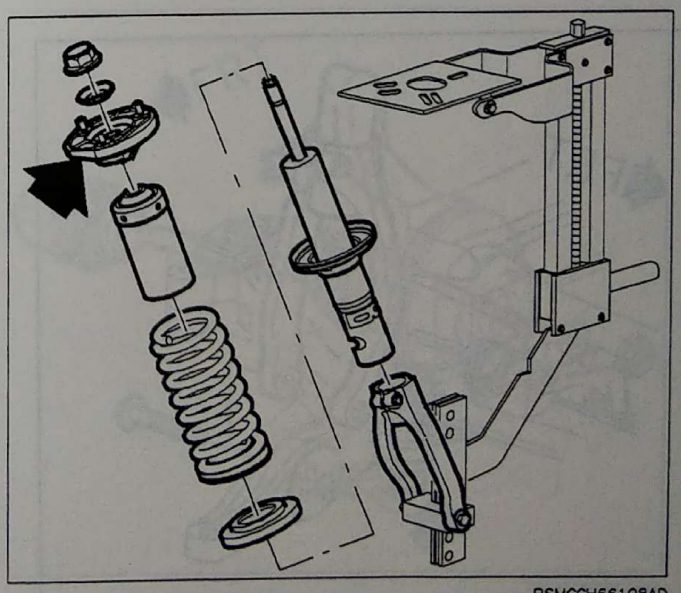
4. Place dust shield assembly onto shock absorber.
5. Install spring isolator and spring onto shock absorber.

IMPORTANT: Make sure that largest coil faces down. Also make sure that the spring is correctly positioned in spring insulator.

6. Install upper mount assembly to spring compressor top using three shock-to-body attaching nuts.

Torque: 23 N•m (17 ft−lbs)

IMPORTANT: Install mount with flat side of upper shock mount facing ouward from spring compressor and aligned with indentation in shock absorber.



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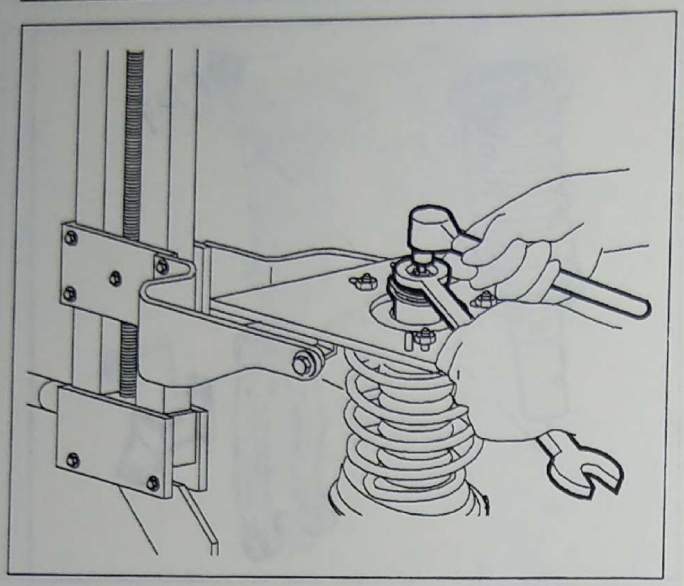

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IMPORTANT: Check to make sure that shock absorber shaft is at its full limit of upwards travel.

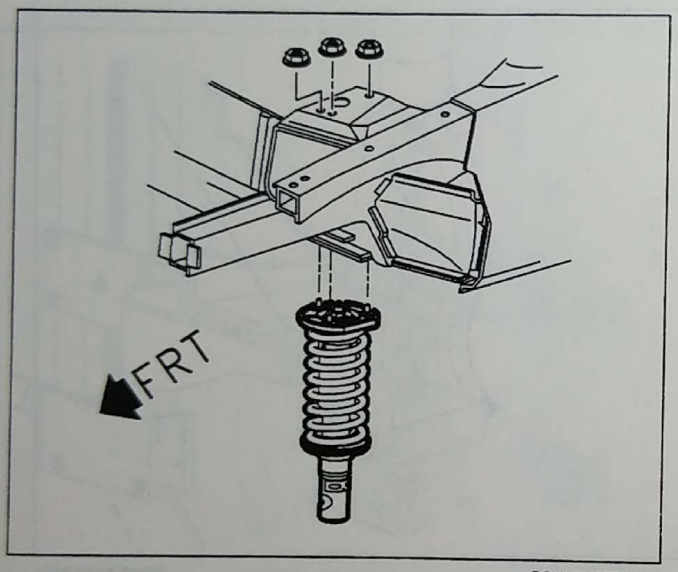
7. Compress the spring, guiding the shock absorber shaft through the upper shock absorber mount assembly until the upper washer and shaft nut can be installed onto the shaft.

IMPORTANT: Do not over compress the spring.

8. Tighten the shaft using a HEX® wrench while holding the shaft nut with a wrench.

Torque: 50 N•m (37 ft−lbs)

9. Release the spring compressor tool.
10. Remove the coil-over-shock assembly from compressor.



PSMGCH65796AB

INSTALLATION

1. Remove yoke to shock absorber pinch bolt and remove yoke.
2. Install coil-over-shock assembly into vehicle.

NOTICE: Use new nuts; torque retention of old nuts may not be sufficient.

3. Attach coil-over-shock to the vehicle body with the three shock absorber mount-to-body attachment fasteners.

Torque: 23 N•m (17 ft−lbs)

4. Slide yoke onto shock absorber assembly, aligning pinch bolt thru hole to indentation in shock absorber assembly.

IMPORTANT: Install yoke to shock absorber pinch bolt with head of bolt towards the front of vehicle.

Torque: 35 N•m (26 ft−lbs)

5. Attach yoke to lower control arm with fastener. Tighten nut.

Torque: 150 N•m (111 ft−lbs)

IMPORTANT: Install front yoke to lower control arm's with head of bolt facing towards rear of vehicle.

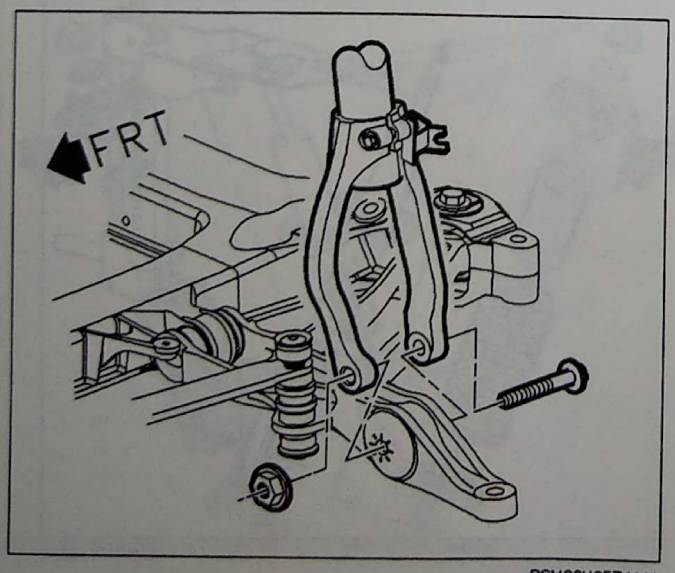
6. Attach wire to bracket on yoke.

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors/drums. Failure to do so can cause wheel lug nuts to loosen in service.

7. Position wheel on hub.
8. Install wheel nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

9. Lower vehicle from hoist.



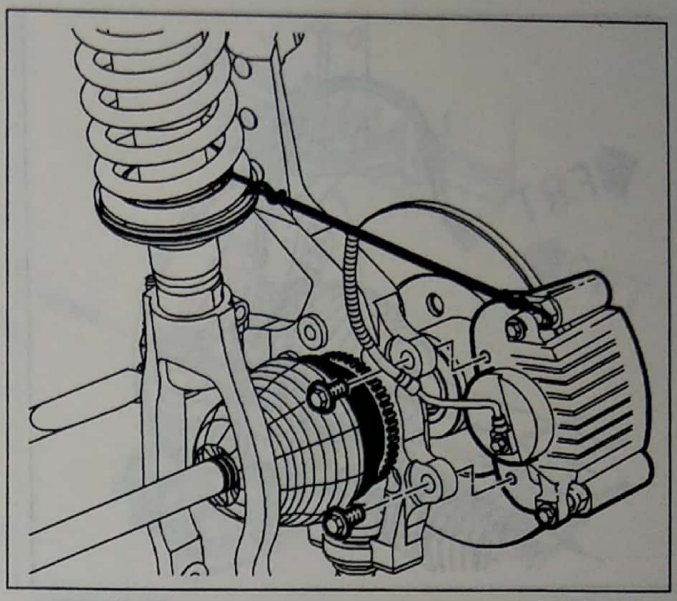
PSMGCH65741AA

STEERING KNUCKLE/LOWER BALL JOINT

REMOVAL

NOTICE: The lower ball joint is factory installed into the aluminum knuckle and must be replaced as an assembly.

1. With vehicle on ground, remove wheel center cap, depress brake pedal and loosen axle to hub nut.
2. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
3. Remove road wheel.
4. Remove front caliper and suspend it from the shock spring with safety wire.



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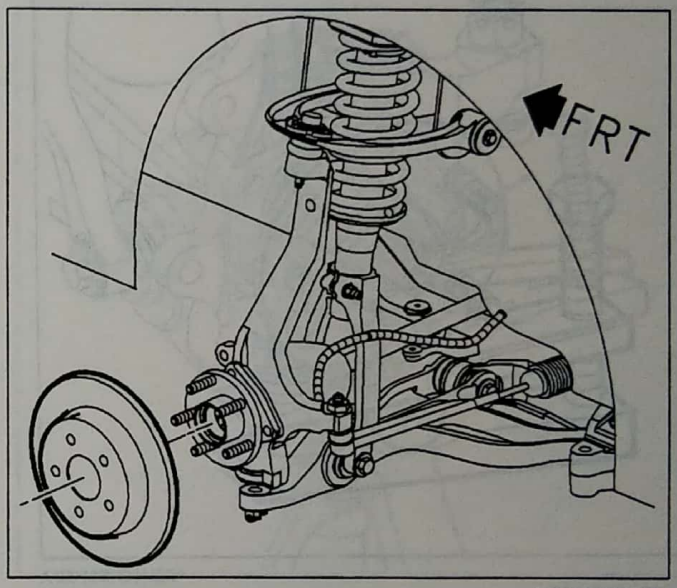
5. Remove rotor.



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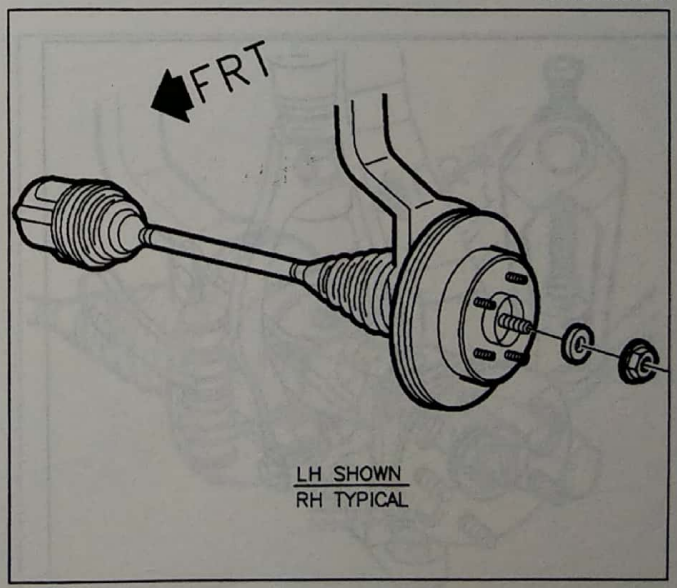
6. Remove nut and washer from axle.



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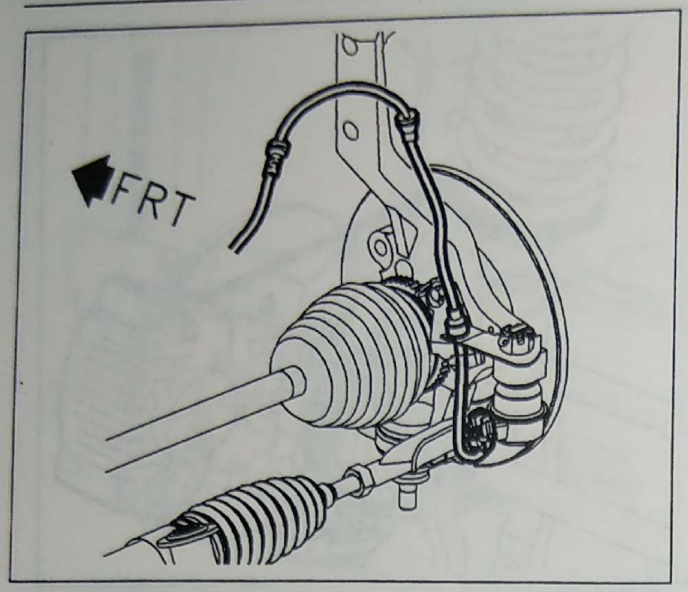
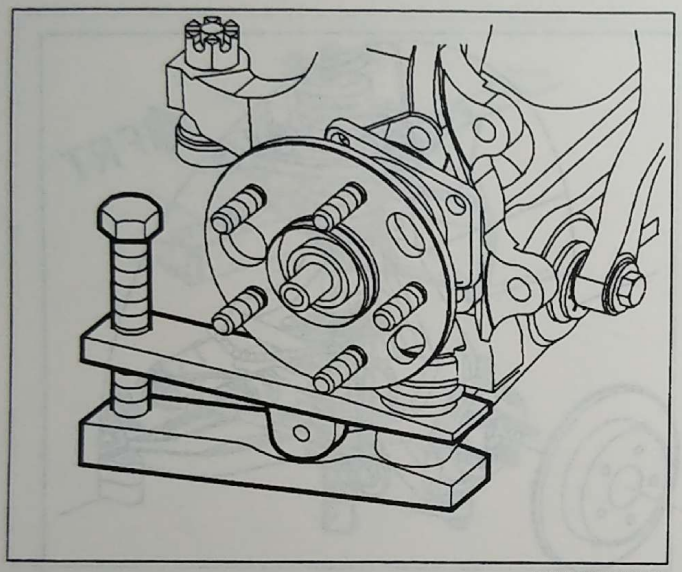


PSMGCH66752AA

7. Remove and discard lower steering knuckle ball joint stud cotter pin.
8. Loosen lower steering knuckle ball joint stud castle nut, until the bottom of castle nut is level with bottom of ball stud.
9. Remove and discard tie rod cotter pin.
10. Remove tie rod end castle nut and wire support.
11. Disconnect electrical connector at ABS wheel speed sensor.
12. Remove wheel speed sensor.



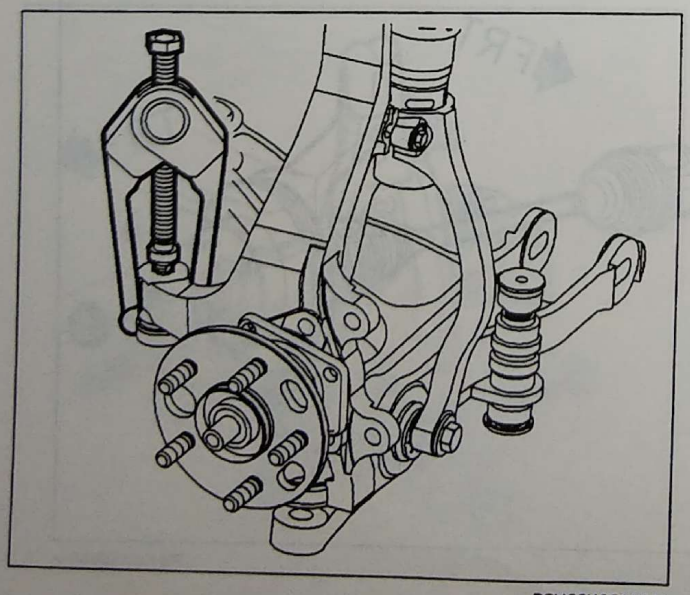
PSMGCH66168AA

NOTICE: All EV1's are equipped with ABS. The outer CV joint has a speed sensor ring. Using the incorrect tool or procedure to separate the control arm from the knuckle can damage the ring, resulting in a loss of ABS operation.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal of the lower ball joint may be damaged.

13. Using SA9132S (or equivalent), separate steering knuckle from lower control arm.

NOTICE: Lubricate threads of tool forcing screw often, using thread lube.

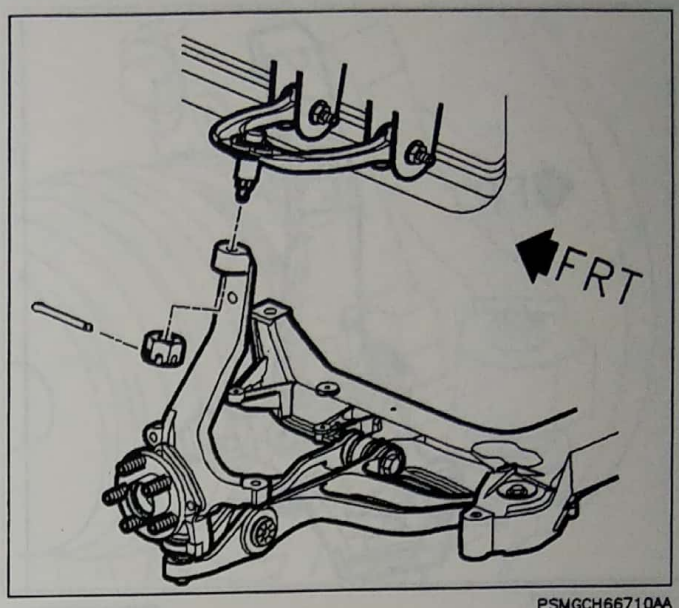


PSMGCH66169AA

14. Remove lower steering knuckle ball joint stud castle nut.
15. Using SA91100C (or equivalent), separate tie rod end from steering knuckle.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal on the tie rod may be damaged.

16. Remove and discard upper control arm ball joint cotter pin.
17. Loosen upper control arm ball joint castle nut.
18. Using SA9132S (or equivalent), separate upper control arm from steering knuckle.



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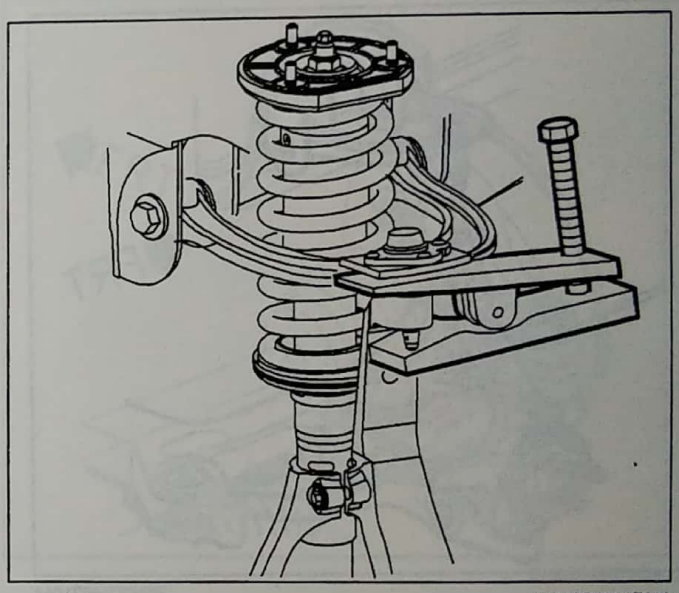
19. Remove upper control arm ball joint castle nut.
20. Support or suspend drive axle assembly.

NOTICE: Never pull on drive axle shaft assembly.

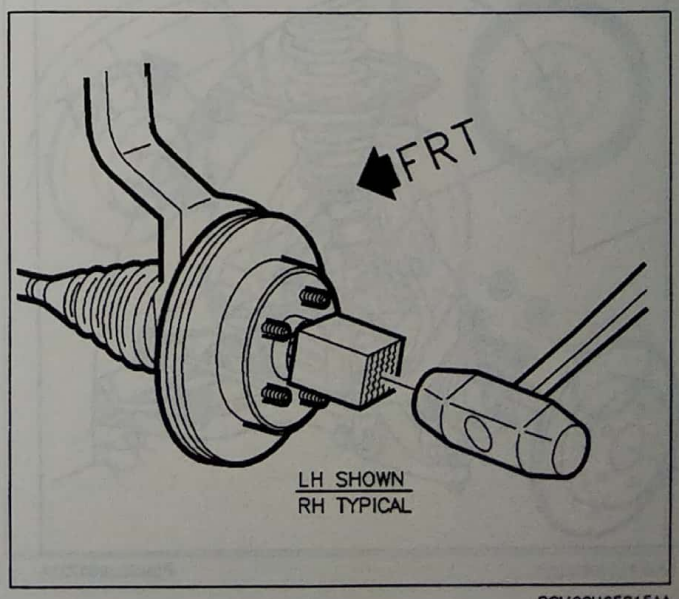


PSMGCH66170AA

21. Remove the knuckle/wheel hub assembly from vehicle.

NOTICE: If difficulty is encountered in separating axle from hub, tap on end of drive axle shaft using a block of wood and a hammer. Do not hammer directly on end of axle.

22. Remove bearing/hub assembly.



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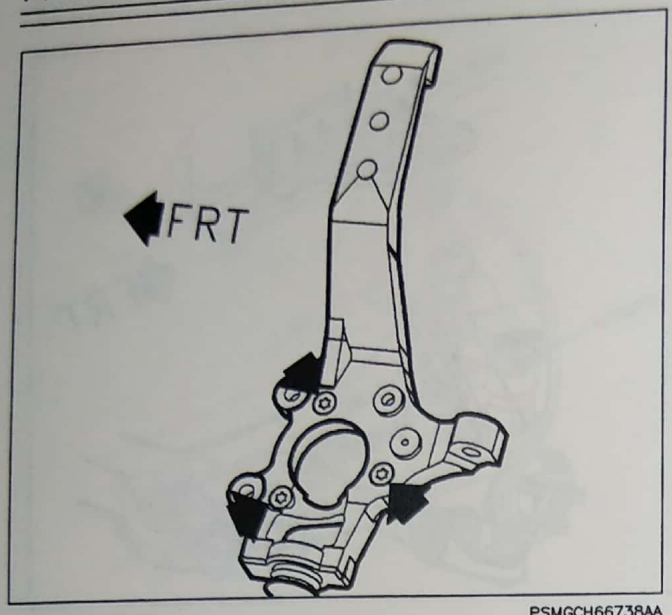

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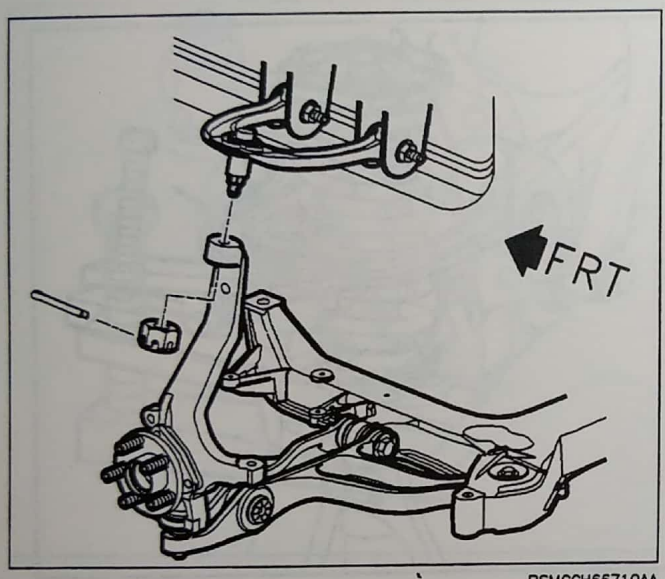

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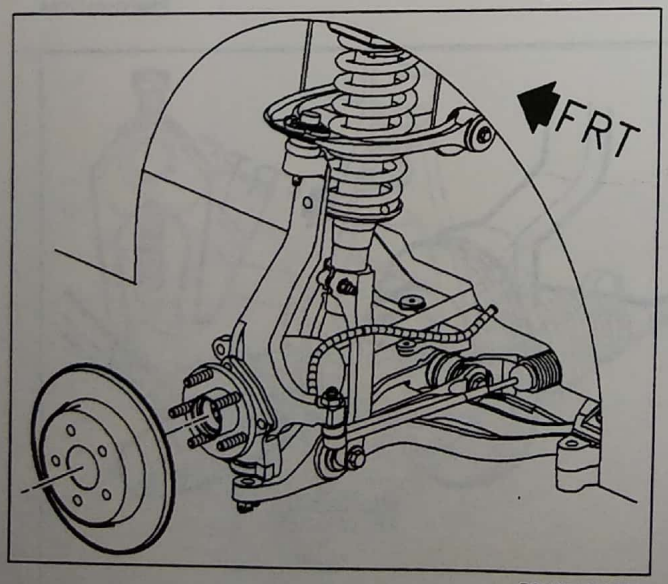


PSMGCH66372AA

INSTALLATION

1. Attach bearing/hub assembly to steering knuckle.

Torque: 80 N•m (59 ft−lbs)

2. Position steering knuckle onto axle shaft and install axle to hub washer and a **new** nut.
3. Install the steering knuckle lower ball joint stud through the opening in the lower control arm and install castle nut.

IMPORTANT: Do not tighten fastener at this time.

4. Install upper ball joint stud through opening in top of steering knuckle and install castle nut.

IMPORTANT: Ball joint stud threads must be thoroughly cleaned.

5. Tighten lower ball joint stud castle nut and install new cotter pin.

Torque: 10 N•m (88 in−lbs) + 120 degrees

6. Tighten upper ball joint stud castle nut and install new cotter pin.

Torque: 10 N•m (88 in−lbs) + 250 degrees

IMPORTANT: If it is necessary to rotate the castle nut after tightening to orient it to the hole in the stud, always tighten the nut to align it; never loosen it.

7. Attach tie rod-to-knuckle with castle nut and a new cotter pin.

Torque: 23 N•m (17 ft−lbs)

IMPORTANT: Tie rod end threads must be thoroughly cleaned.

IMPORTANT: If it is necessary to rotate the castle nut after tightening to orient it to the hole in the stud, always tighten the nut to align it; never loosen it.

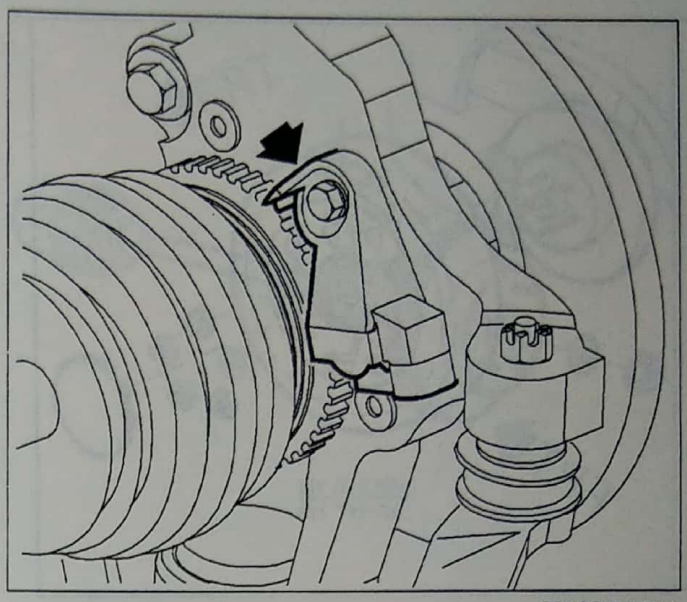
8. Install brake rotor onto wheel hub.
9. Install front brake caliper and mounting bracket.

Torque: 110 N•m (81 ft−lbs)

CamScanner

10. Install wheel speed sensor.

Torque: 11 N•m (97 in−lbs)



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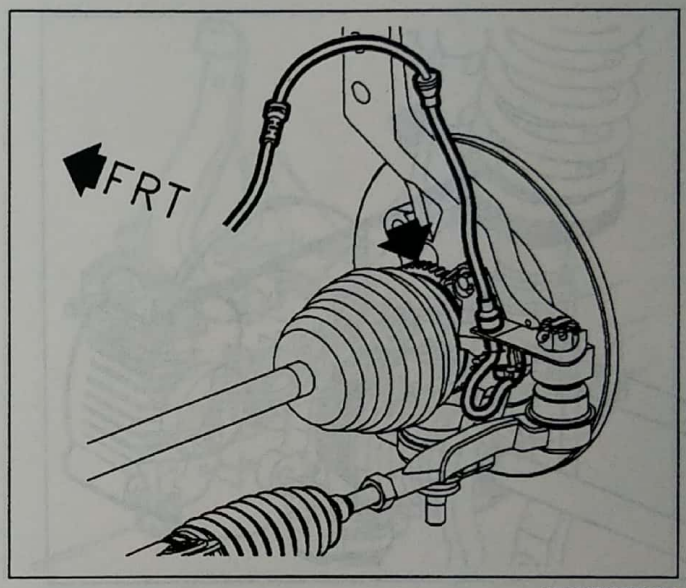
11. Install electrical connector to ABS wheel speed sensor.
12. Depress brake pedal and tighten axle to hub nut.

Torque: 260 N•m (192 ft−lbs)

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors/drums. Failure to do so can cause wheel lug nuts to loosen in service.

13. Position wheel on hub.



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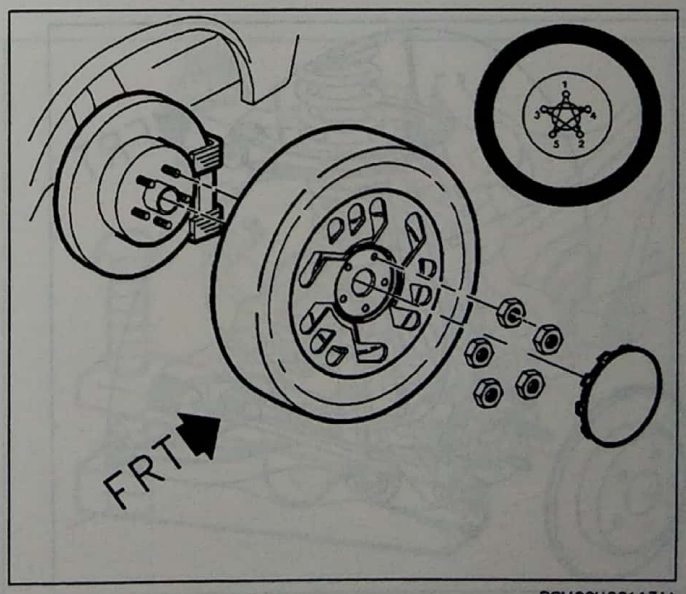
14. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

15. Lower vehicle from hoist.
16. Perform vehicle wheel alignment. (Refer to "Wheel Alignment" in "Alignment, Wheels and Tires" in this manual.)



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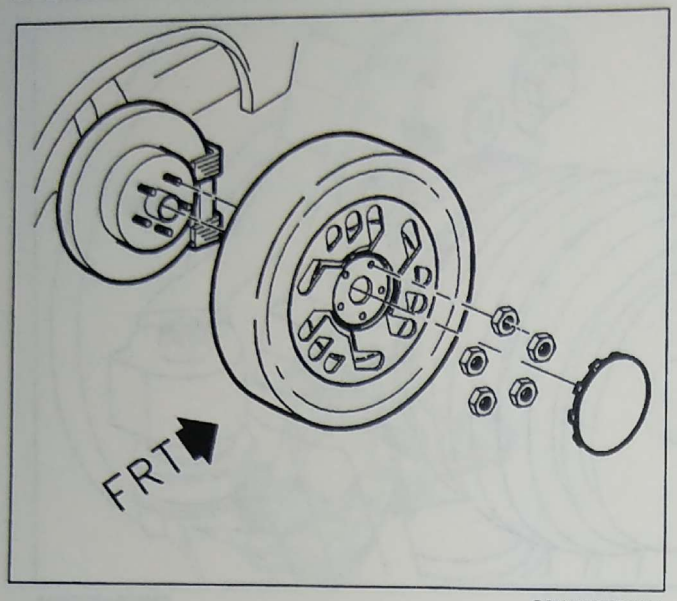

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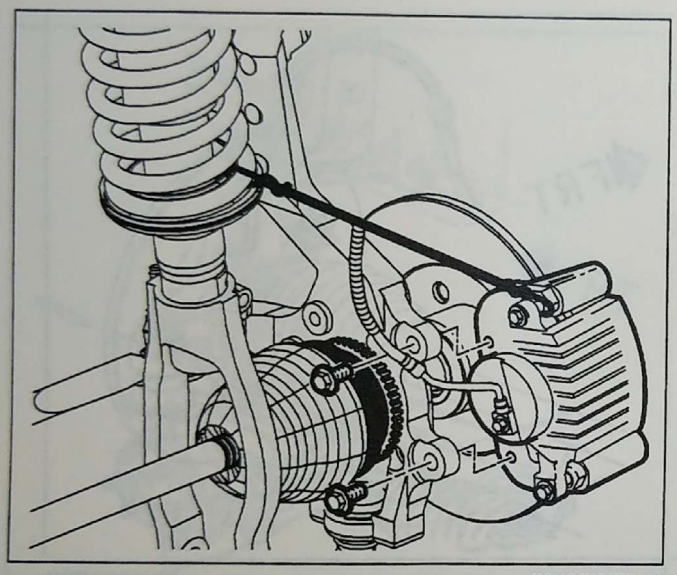
WHEEL BEARING/HUB

REMOVAL

1. With vehicle on ground, remove wheel center cap, depress brake pedal and loosen axle to hub nut.
2. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
3. Remove road wheel.



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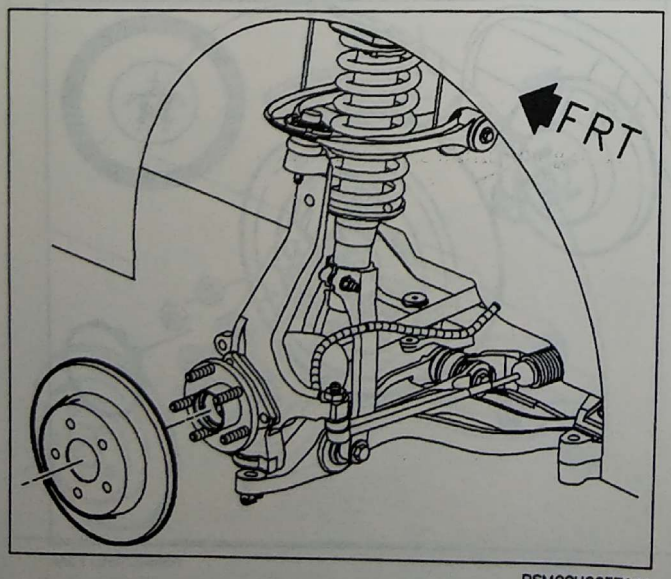
4. Remove front caliper and suspend it from the shock absorber spring with safety wire.



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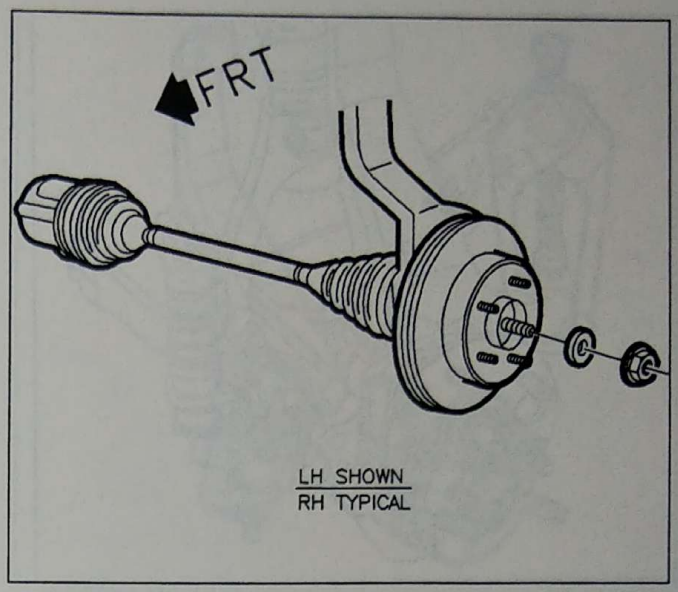
5. Remove rotor.

6. Remove nut and washer from axle.



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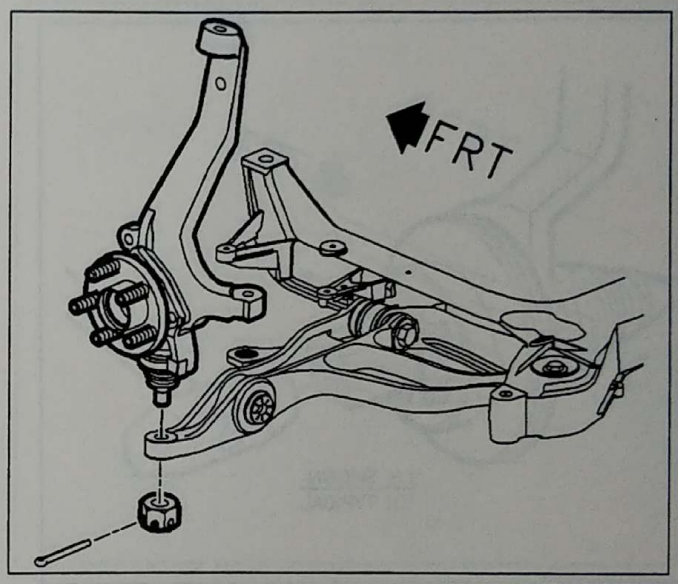
7. Remove and discard lower steering knuckle ball joint stud cotter pin.
8. Loosen lower steering knuckle ball joint stud castle nut, until the bottom of castle nut is level with bottom of ball stud.
9. Remove and discard tie rod cotter pin.
10. Remove tie rod end castle nut and wire support.
11. Disconnect electrical connector at ABS wheel speed sensor.



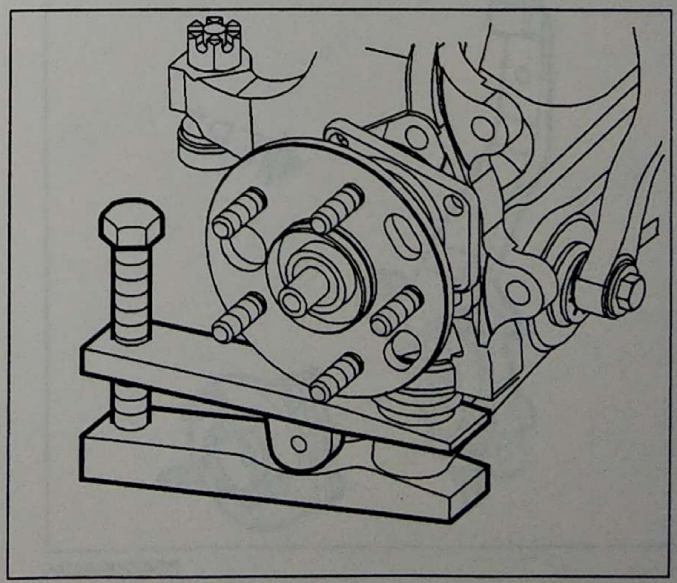
PSMGCH66711AA

NOTICE: All EV1's are equipped with ABS. The outer CV joint has a speed sensor ring. Using the incorrect tool or procedure to separate the control arm from the knuckle can damage the ring, resulting in a loss of ABS operation.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal of the lower ball joint may be damaged.

12. Using SA9132S (or equivalent), separate steering knuckle from lower control arm.

NOTICE: Lubricate threads of tool forcing screw often, using thread lube.



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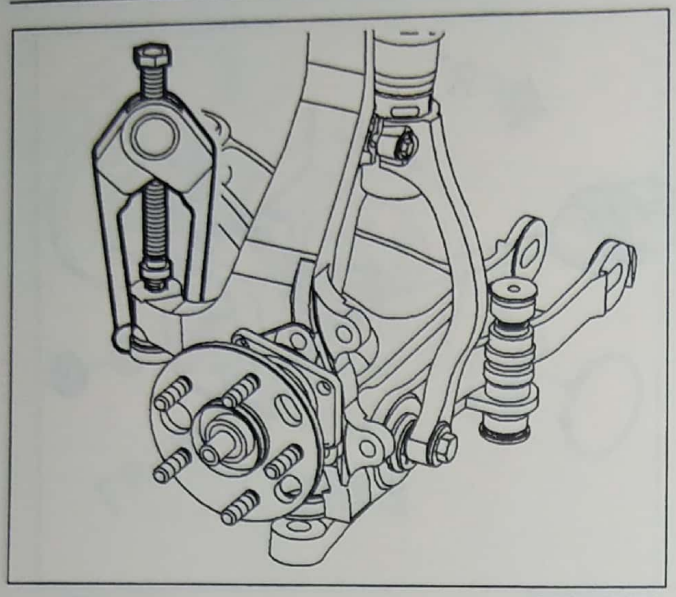


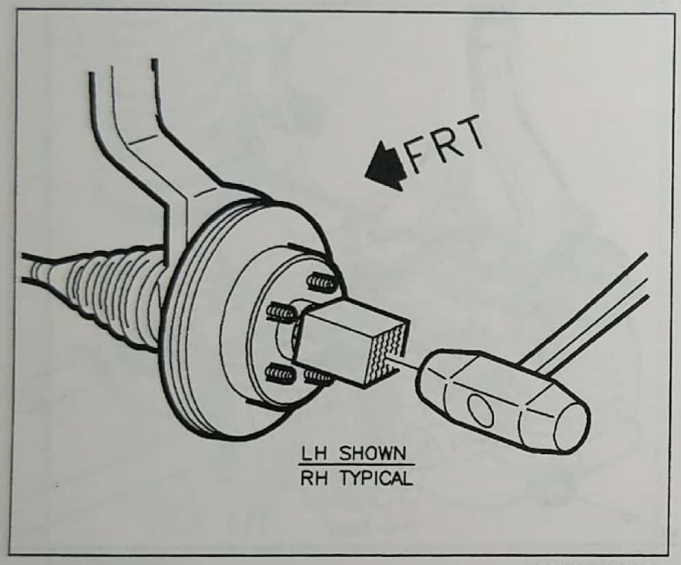
PSMGCH66169AA

13. Remove lower steering knuckle ball joint stud castle nut.
14. Using SA91100C (or equivalent), separate tie rod end from steering knuckle.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal on the tie rod may be damaged.

15. Remove electrical wire from lower control arm.
16. Support or suspend drive axle assembly.

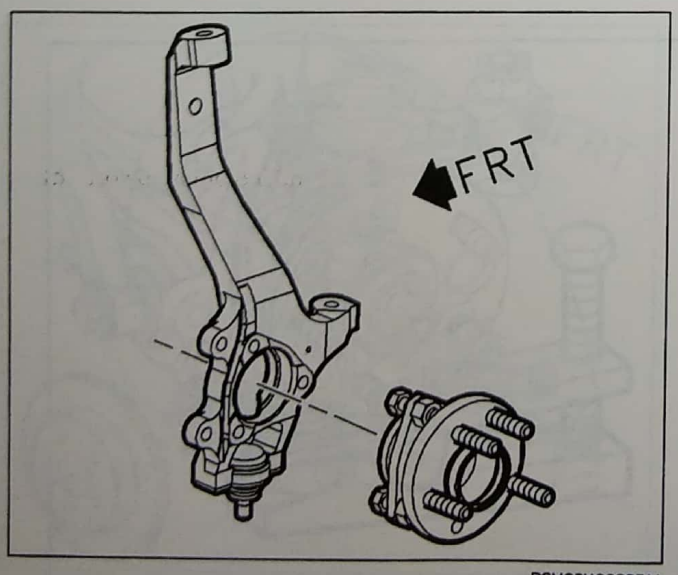
NOTICE: Never pull on drive axle shaft assembly.



PSMGCH65815AA

17. Tilt the lower portion of the steering knuckle outward and separate drive axle from steering knuckle.

NOTICE: If difficulty is encountered in separating axle from hub, tap on end of drive axle shaft using a block of wood and a hammer. Do not hammer directly on end of axle.



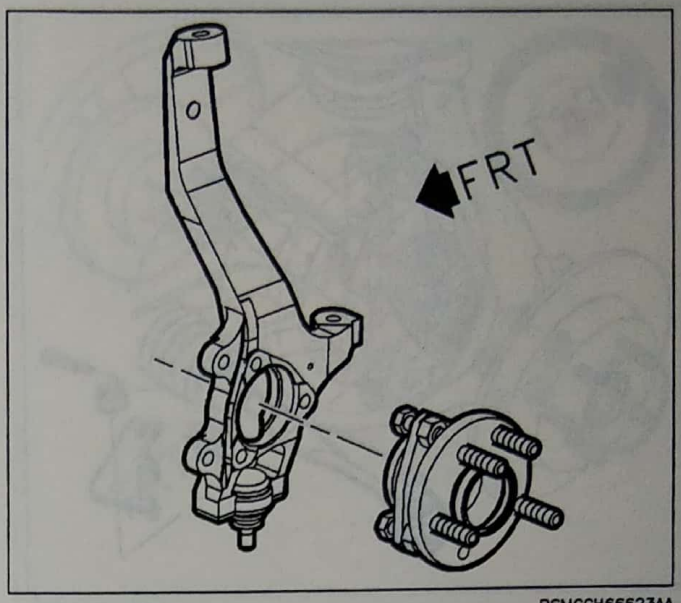
PSMGCH66623AA

18. Remove the three attachment fasteners that secure hub and bearing to steering knuckle.
19. Remove hub and bearing assembly from steering knuckle.

INSTALLATION

1. Install hub and bearing assembly into steering knuckle.
2. Tighten the three attachment fasteners that secure hub and bearing to steering knuckle.

Torque: 80 N•m (59 ft−lbs)



PSMGCH66623AA

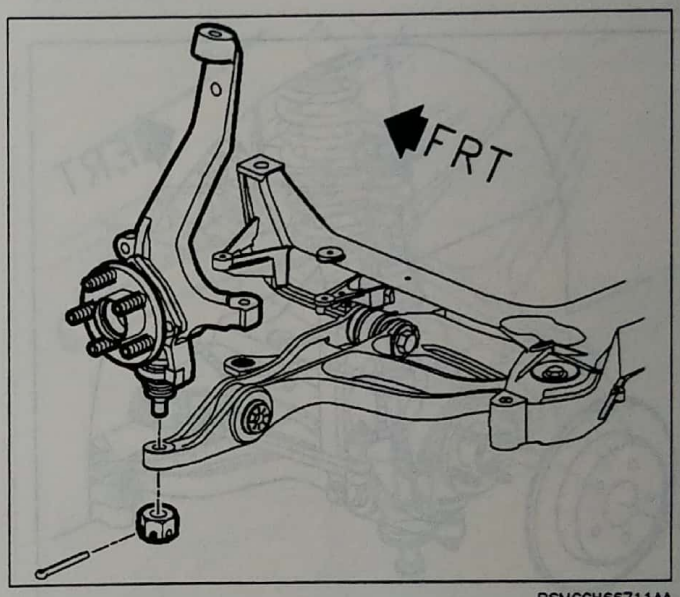
3. Position steering knuckle onto axle shaft and install axle to hub washer and a **new** nut.
4. Install the steering knuckle lower ball joint stud through the opening in the lower control arm and install castle nut.

IMPORTANT: Do not tighten fastener at this time.

IMPORTANT: Ball joint stud threads must be thoroughly cleaned.

5. Tighten lower ball joint stud castle nut and install new cotter pin.

Torque: 10 N•m (88 in−lbs) + 120 degrees



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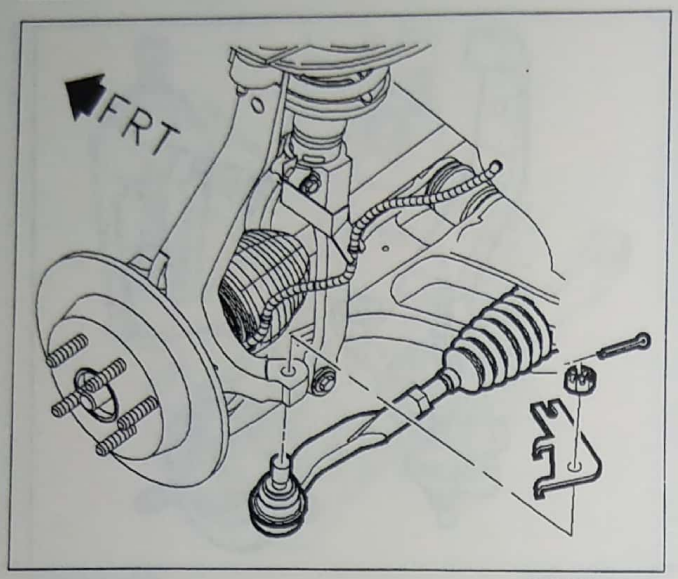


PSMGCH70087AA

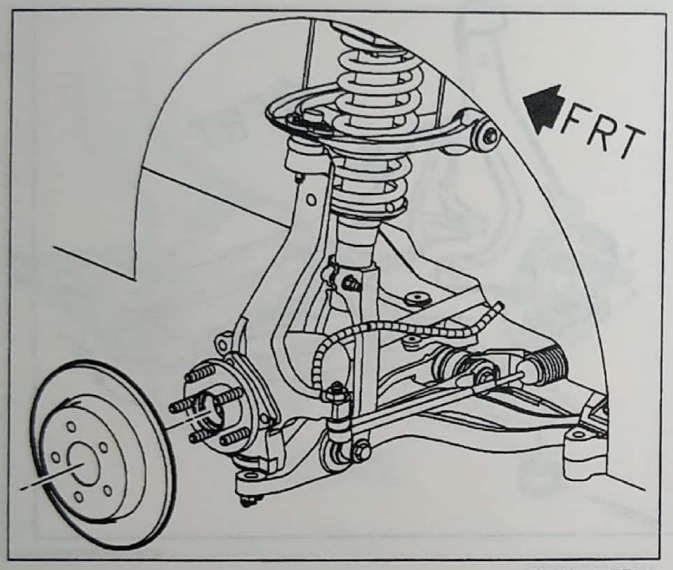
IMPORTANT: If it is necessary to rotate the castle nut after tightening to orient it to the hole in the stud, always tighten the nut to align it; never loosen it.

6. Attach tie rod-to-knuckle with electrical wire bracket, castle nut and a new cotter pin.

Torque: 23 N•m (17 ft−lbs)

IMPORTANT: Tie rod end threads must be thoroughly cleaned.

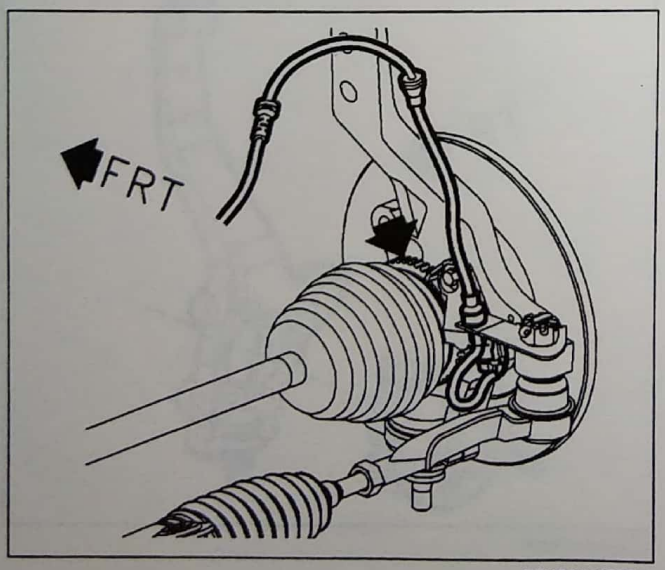
IMPORTANT: If it is necessary to rotate the castle nut after tightening to orient it to the hole in the stud, always tighten the nut to align it; never loosen it.



PSMGCH66372AA

7. Install brake rotor onto wheel hub.
8. Install front brake caliper and mount bracket.

Torque: 110 N•m (81 ft−lbs)



PSMGCH66753AA

9. Install electrical connector to ABS wheel speed sensor.
10. Depress brake pedal and tighten axle to hub nut.

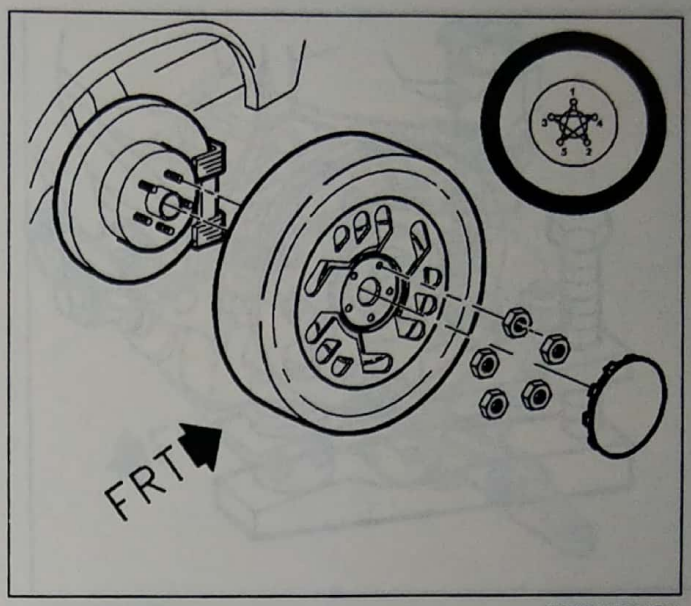
Torque: 260 N•m (192 ft−lbs)

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors/drums. Failure to do so can cause wheel lug nuts to loosen in service.

11. Position wheel on hub.
12. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

13. Lower vehicle from hoist.
14. Perform vehicle wheel alignment (Refer to "Wheel Alignment" in "Alignment, Wheels and Tires" in this manual.)



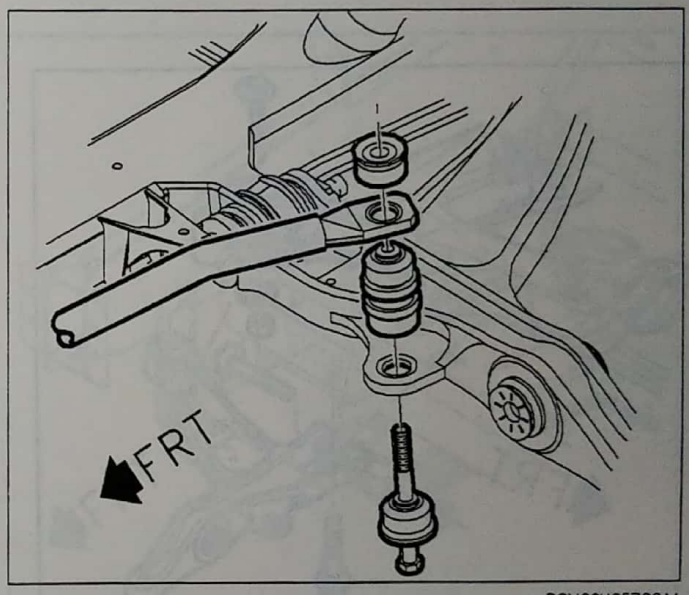
PSMGCH66113AA

LOWER CONTROL ARM/REAR BUSHING

REMOVAL

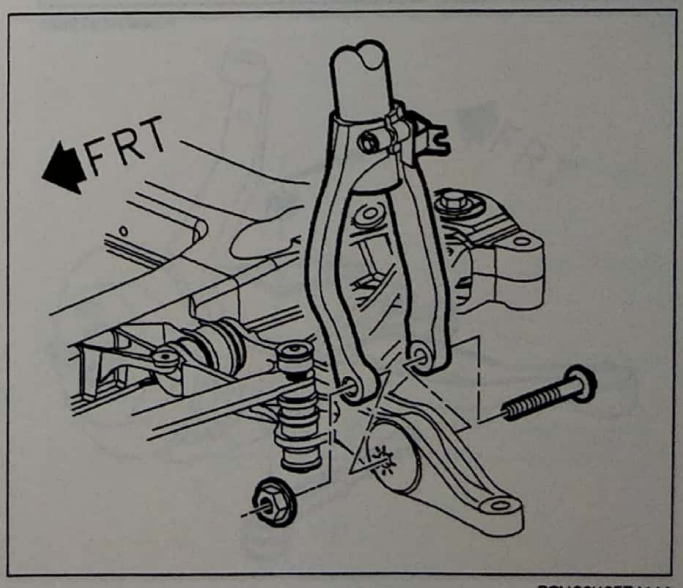
NOTICE: The rear lower control arm bushing is factory attached to the lower control arm and must be replaced as an assembly.

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)



PSMGCH65788AA

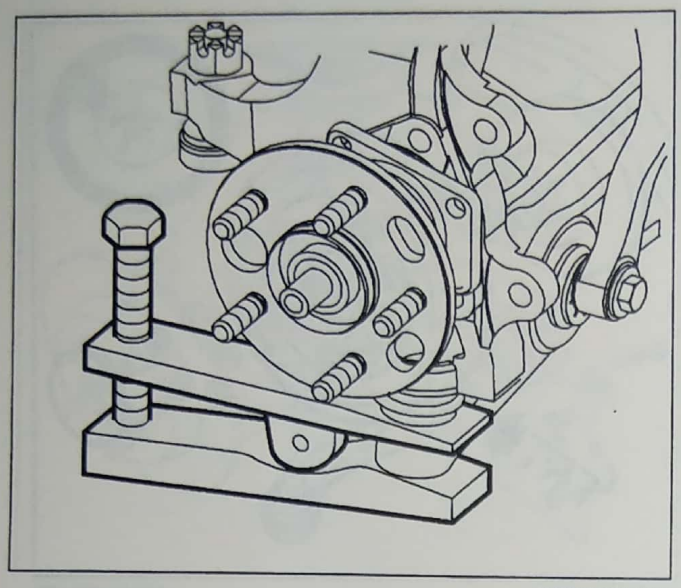
2. Remove road wheel.
3. Disconnect front stabilizer link from lower control arm, using EV9716S Stabilizer Link Socket (or equivalent).
4. Remove front yoke from lower control arm.
5. Remove and discard lower steering knuckle ball stud cotter pin.
6. Loosen lower steering knuckle ball joint stud castle nut, until the bottom of castle nut is level with the bottom of ball stud.



PSMGCH65741AA

NOTICE: Care must be taken to prevent damage to the speed sensor ring. Minor surface damage to the speed sensor ring can result in ABS system malfunctions.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal on the lower ball joint may be damaged.



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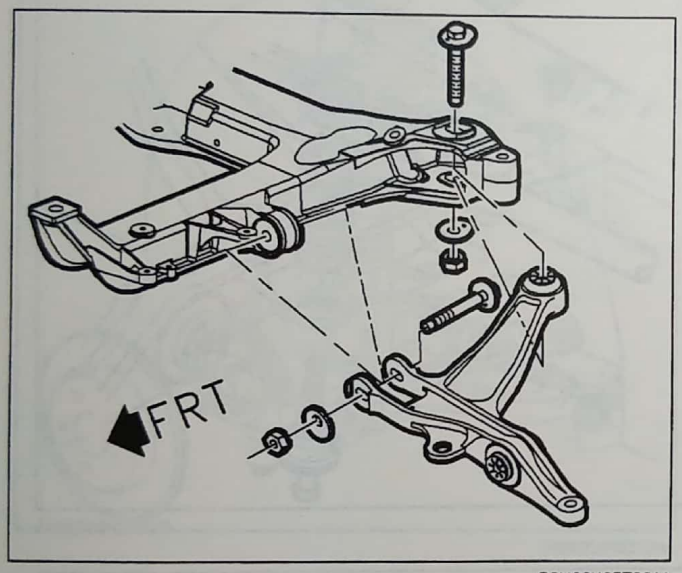


PSMGCH65799AA

IMPORTANT: It may be necessary to support upper control arm and knuckle assembly to prevent any damage to components.

7. Using SA9132S (or equivalent), separate steering knuckle from lower control arm.

NOTICE: Lubricate threads of tool forcing screw often, using thread lube.

8. Remove lower control arm ball stud castle nut.
9. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)
10. Lower cradle. (Refer to "Cradle Removal" in "Cradle" in this manual.)
11. Loosen front cradle bolts.

IMPORTANT: Do not remove the front cradle bolts.

12. Remove rear cradle bolts.
13. Lower rear of cradle.
14. Remove both front and rear nut, cam and bolt/cam assemblies from control arm.

IMPORTANT: Mark original position of cam adjusters before removal. This will ease in alignment procedures later.

15. Remove lower control arm from vehicle.

CamScanner

INSTALLATION

1. Install lower control arm to cradle.
2. Install both front and rear bolt/cam assemblies, cam and nut.

IMPORTANT: Forward cam must be oriented with chamfered edge towards control arm.

IMPORTANT: Align index marks of cam adjusters before tightening bolts. This will aid in alignment procedures later.

IMPORTANT: Tighten nut on bolt/cam assemblies.

Torque: 150 N•m (111 ft−lbs)

3. Install rear cradle bolts.

Torque: 180 N•m (133 ft−lbs)

4. Tighten front cradle bolts.

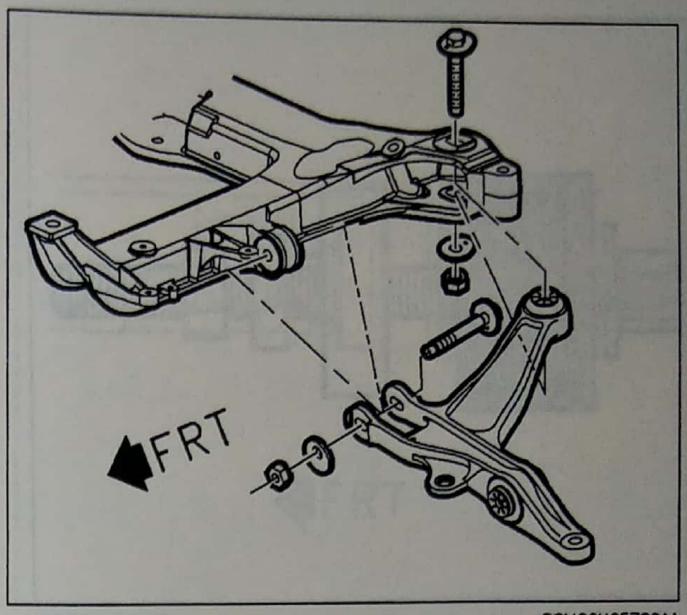
Torque: 180 N•m (133 ft−lbs)

5. Install the steering knuckle lower ball joint stud through the opening in the lower control arm and install castle nut.

IMPORTANT: Ball joint stud threads must be thoroughly cleaned.

6. Tighten lower ball joint stud castle nut and install new cotter pin.

Torque: 10 N•m (88 in−lbs) + 120 degrees



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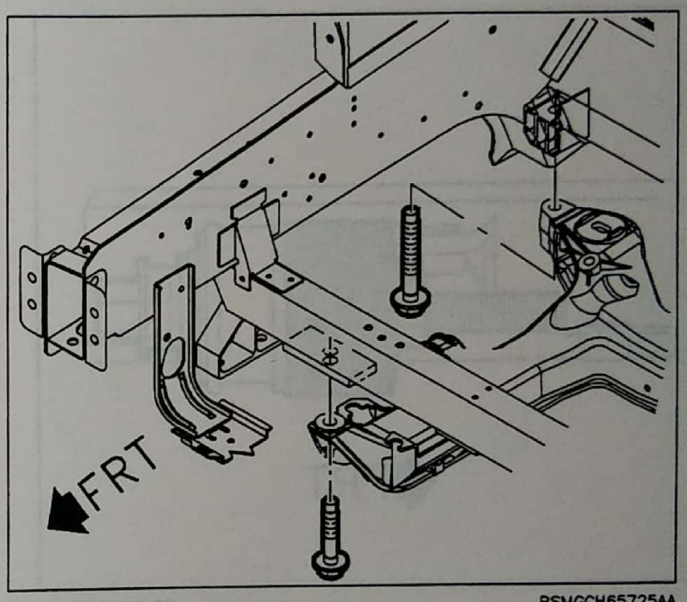


PSMGCH65725AA

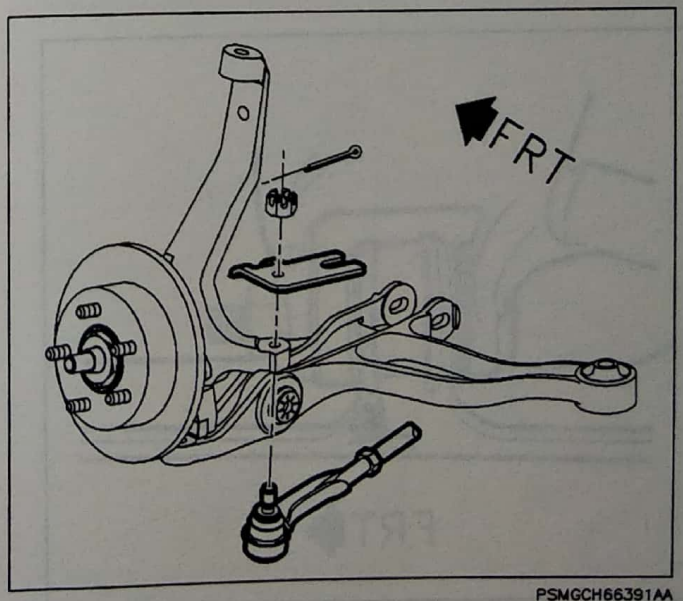
7. Attach tie rod-to-knuckle with electrical wire bracket, castle nut and a new cotter pin.

Torque: 23 N•m (17 ft−lbs)

IMPORTANT: Tie rod end threads must be thoroughly cleaned.

IMPORTANT: If it is necessary to rotate the castle nut after tightening to orient it to the hole in the stud, always tighten the nut to align it; never loosen it.

8. Perform cradle installation. (Refer to "Cradle Installation" in "Cradle" in this manual.)



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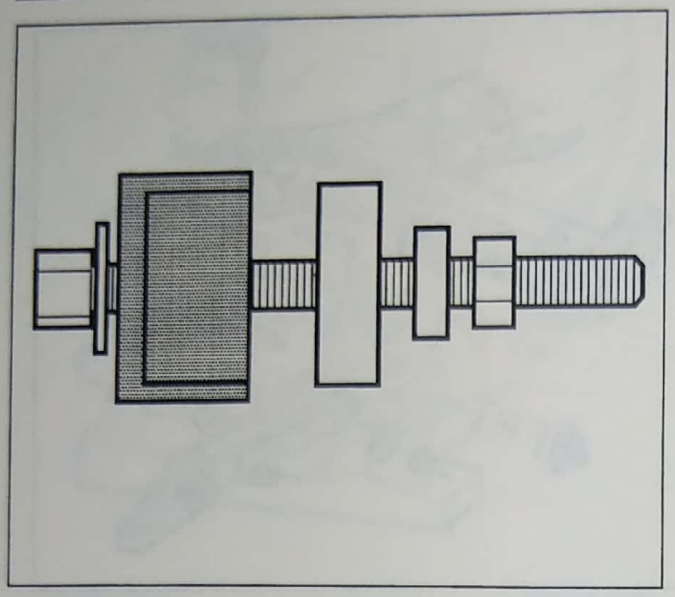

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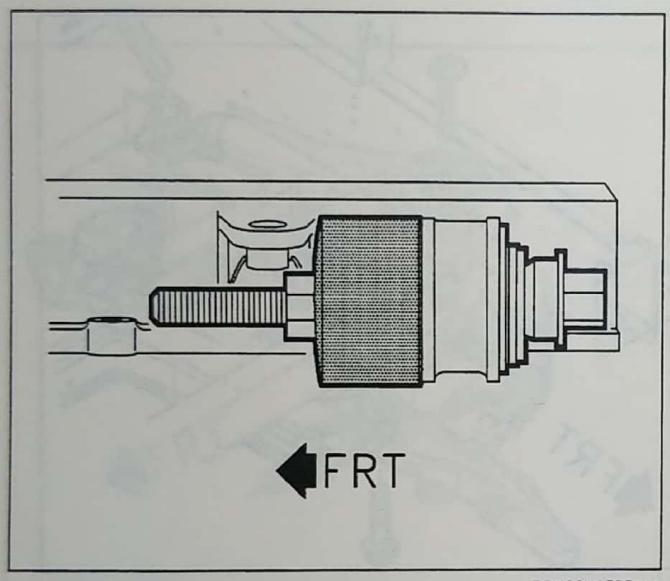
FRONT LOWER CONTROL ARM FORWARD BUSHING

REMOVAL

1. Perform lower control arm removal. (Refer to "Lower Control Arm Removal" in this manual.)



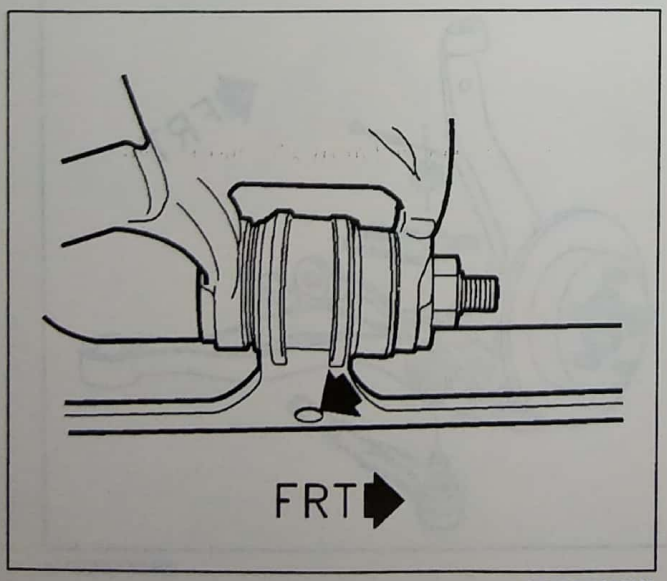
PSMGCH65854AA

2. Install front lower control arm bushing removal/installation tool EV9706S (or equivalent) as shown in illustration.

IMPORTANT: Bushing receiver (half round portion of the tool) must be aligned with bushing center line when installing tool. Bushing receiver will not slide over the bushing ferrule from the side.

3. Press front lower control arm bushing out of cradle.

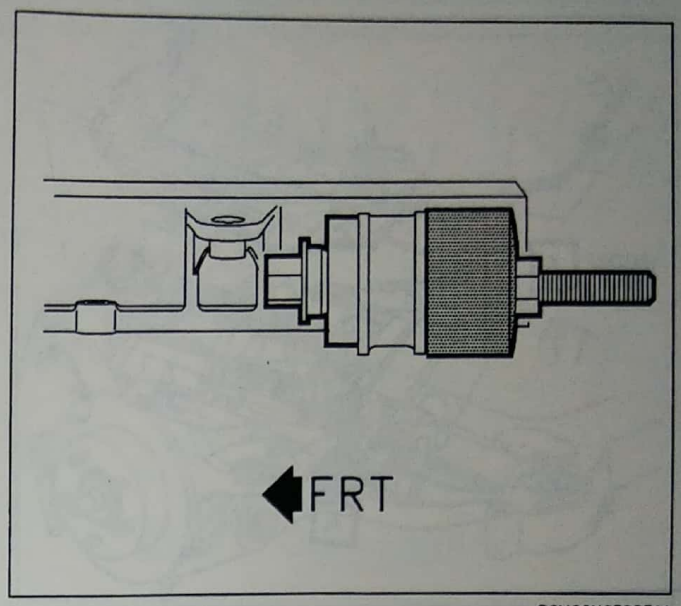
IMPORTANT: If difficulty is encountered removing bushing, locate hole on underside of cradle and apply penetrating oil to bushing housing and cradle socket.



PSMGCH66104AA

INSTALLATION

1. Install bushing into cradle opening with large diameter facing forward.
2. Using removal/installation tool EV9706S (or equivalent) as shown in illustration, press new bushing into cradle until fully seated.
3. Install front lower control arm. (Refer to "Lower Control Arm Installation" in this manual.)



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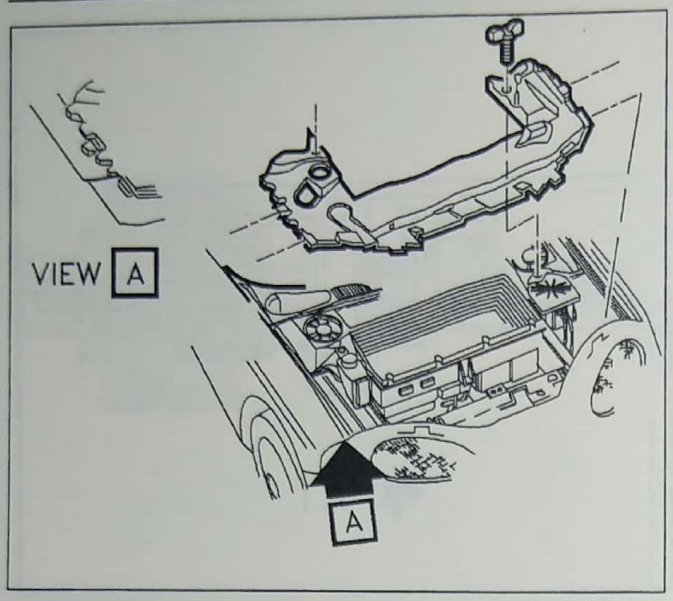

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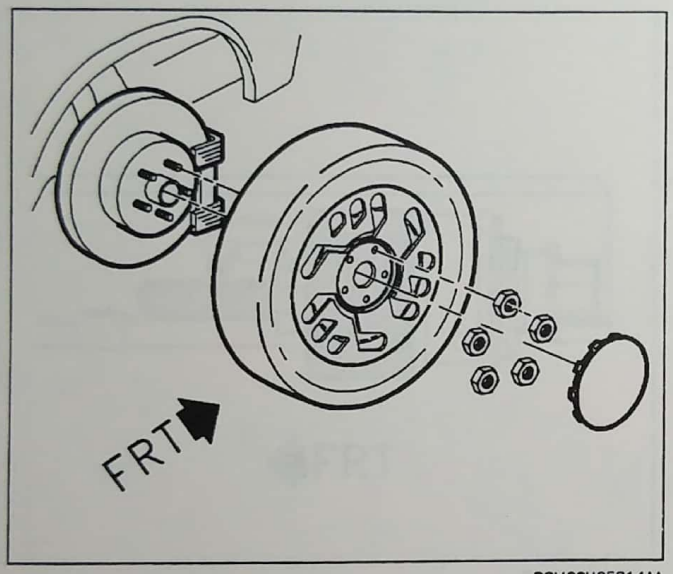
FRONT UPPER CONTROL ARM/UPPER BALL JOINT

REMOVAL

NOTICE: The upper ball joint and bushings are factory attached to the upper control arm and must be replaced as an assembly.

1. Remove engine compartment sight shield.
2. Disconnect clips retaining cooling system expansion tank to bracket.
3. Position expansion tank upwards.
4. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)



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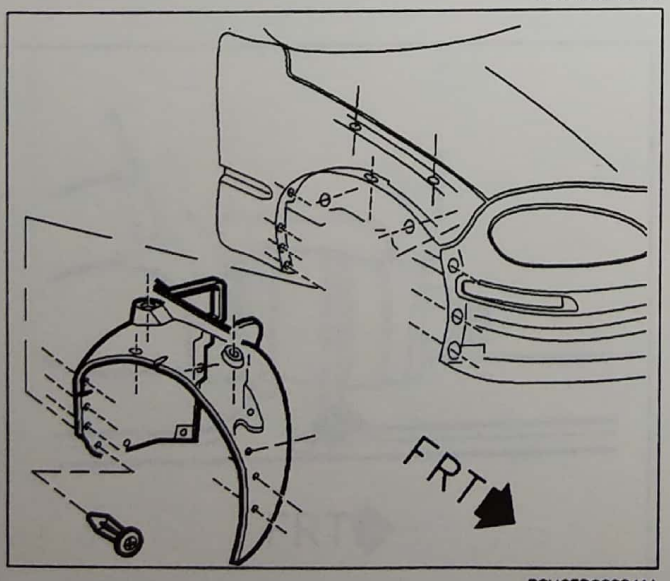
5. Remove road wheels.



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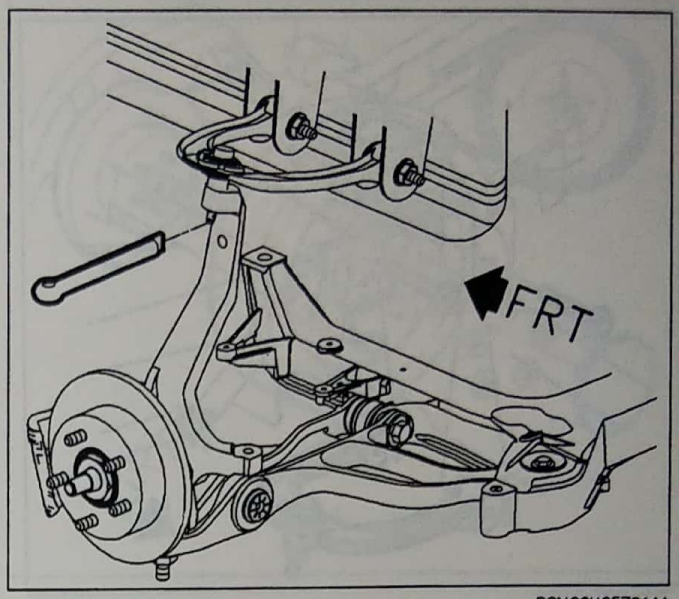
6. Remove front wheel house liner.

IMPORTANT: Support steering knuckle and lower control arm to prevent any damage to components.

7. Remove and discard upper control arm ball joint stud cotter pin.
8. Loosen upper steering knuckle ball joint stud castle nut, until the bottom of castle nut is level with bottom of ball stud.

NOTICE: Do not attempt to separate the joint using a wedge-type tool because the seal on the upper ball joint rod may be damaged.

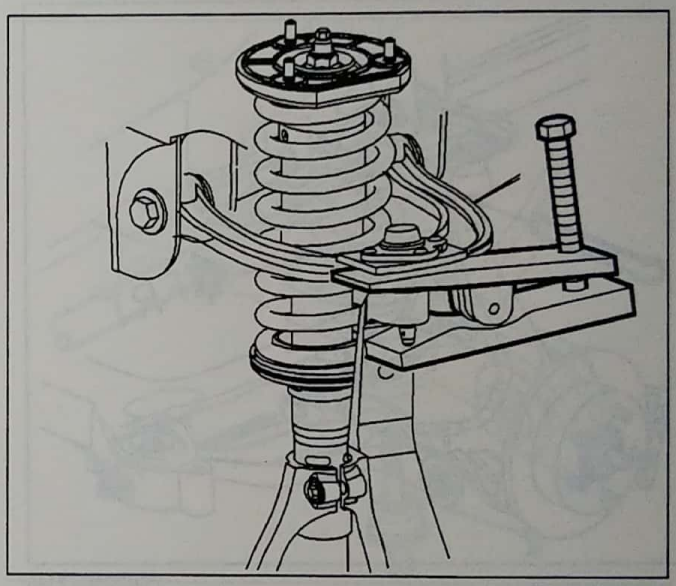


PSMGCH65791AA

9. Using SA9132S (or equivalent), separate steering knuckle from upper control arm.

NOTICE: Lubricate threads of tool forcing screw often, using thread lube.

10. Remove upper control arm ball stud castle nut.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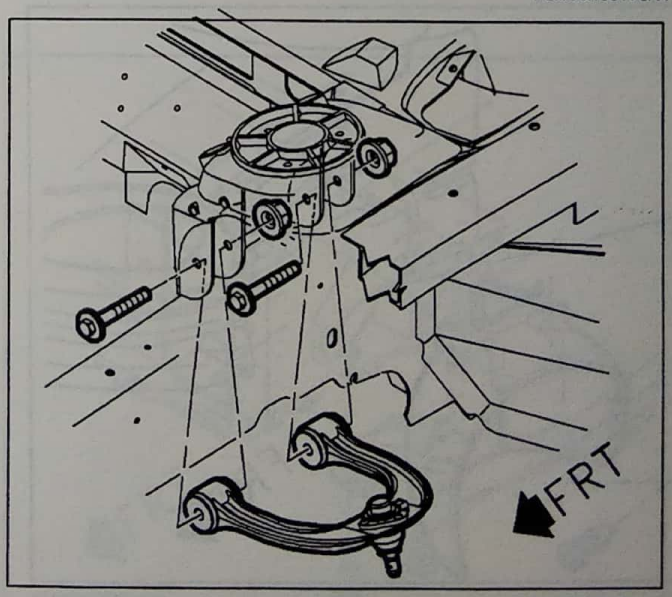
11. Remove fasteners securing upper control arm to body.
12. Remove upper control arm.



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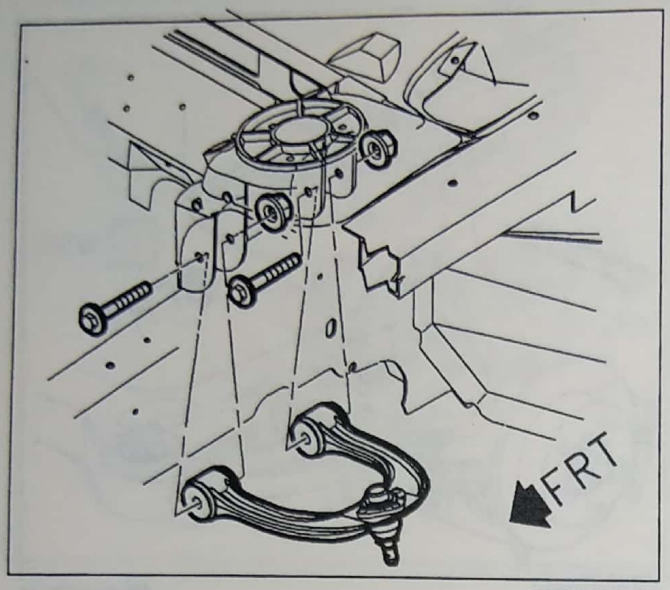

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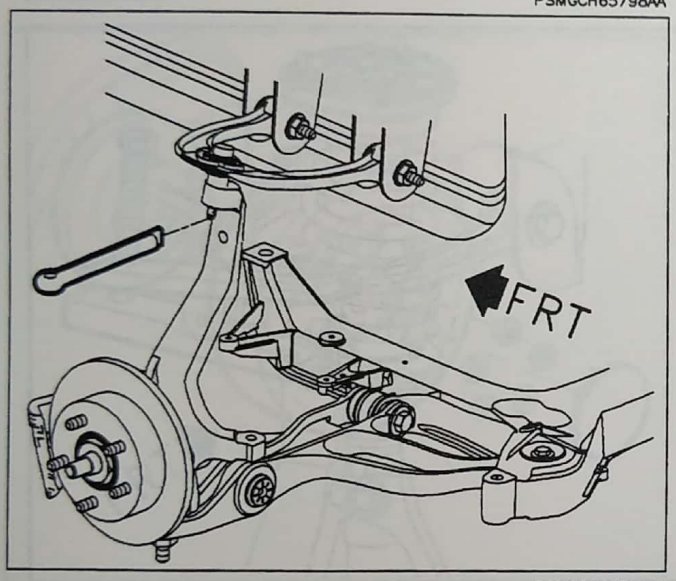

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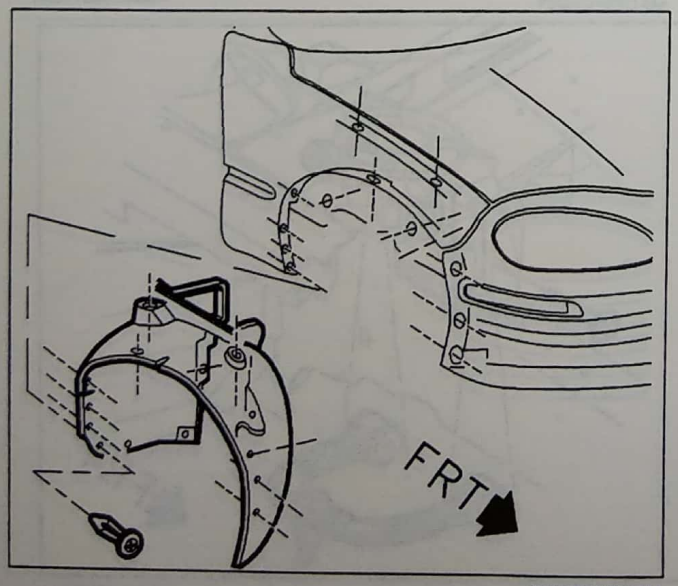


PSMGEP66024AA

INSTALLATION

1. Install upper control arm to body.
2. Install fasteners securing upper control arm to body with bolt heads facing towards front of vehicle. Do not tighten fasteners at this time.
3. Install upper control arm ball joint stud through opening in top of steering knuckle and install castle nut.

IMPORTANT: Ball joint stud threads must be thoroughly cleaned.

4. Tighten upper ball joint stud castle nut and install new cotter pin.

Torque: 10 N•m (88 in−lbs) + 250 degrees

IMPORTANT: If it is necessary to rotate the castle nut after tightening to orient it to the hole in the stud, always tighten the nut to align it; never loosen it.

5. Remove support from steering knuckle and lower control arm.
6. Tighten bolts securing upper control arm to body.

Torque: 80 N•m (59 ft−lbs)

7. Install front wheel house liner.

Torque: 6 N•m (53 in−lbs)

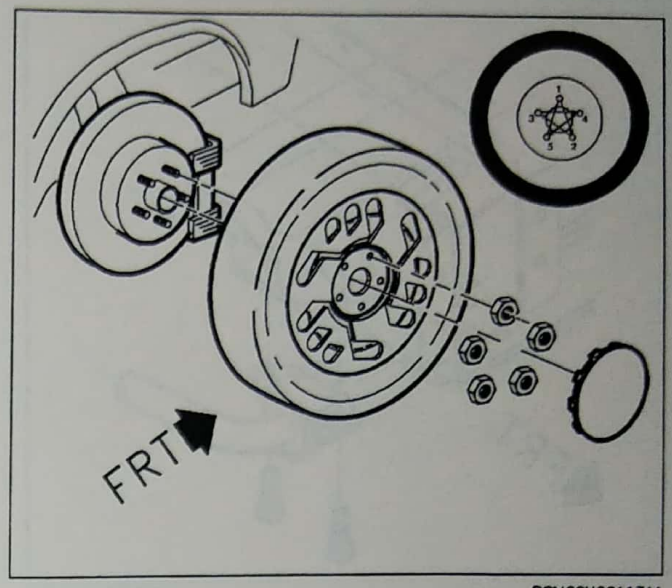
CamScanner

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

8. Position wheel on hub.
9. Install wheel nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft–lbs)

10. Lower vehicle from hoist.
11. Position cooling system expansion tank into bracket and secure with clips.
12. Perform vehicle wheel alignment. (Refer to "Wheel Alignment" in "Alignment, Wheels and Tires" in this manual.)



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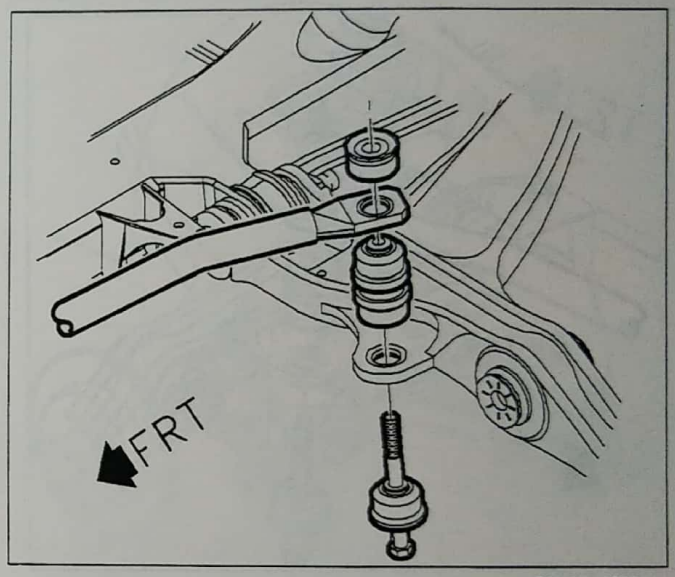
FRONT STABILIZER

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)
3. Disconnect front stabilizer links from lower control arms using EV9716S Stabilizer Link Socket (or equivalent).



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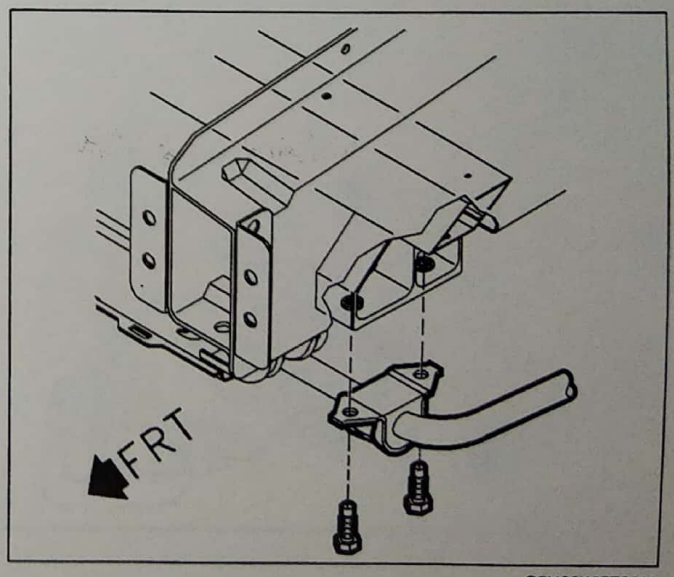
4. Remove clamp/insulator fasteners.
5. Remove front stabilizer from vehicle.



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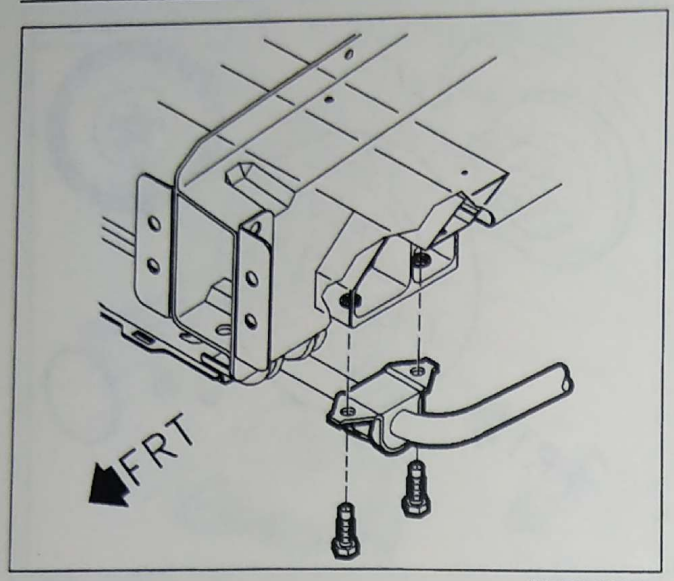


PSMGCH65789AA

INSTALLATION

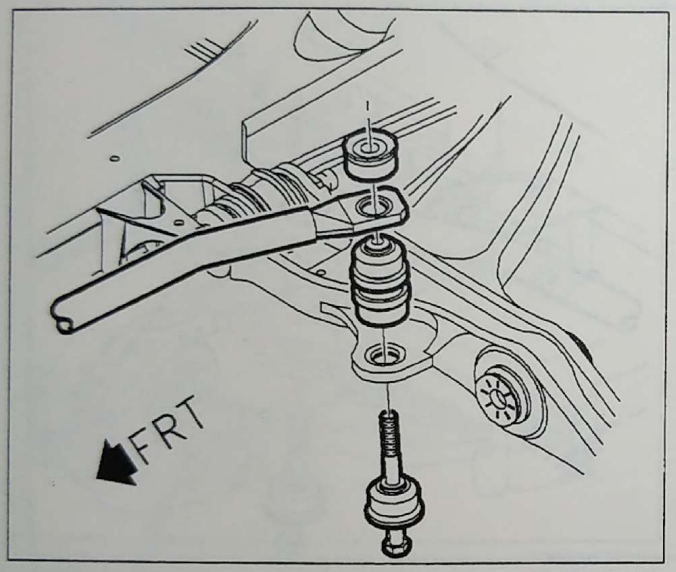
1. Install insulators and clamps onto stabilizer bar.

IMPORTANT: Split in insulator to be oriented towards the front of vehicle.

2. Install stabilizer with insulators and clamps to body crossmember and secure with fasteners.

Torque: 25 N•m (18 ft−lbs)

IMPORTANT: Orange paint mark must be located to the left side of vehicle.



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3. Attach stabilizer bar to lower control arm links using EV9716S Stabilizer Link Socket (or equivalent).

Torque: 10 N•m (89 in−lbs)

4. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)

Torque: 6 N•m (53 in−lbs)

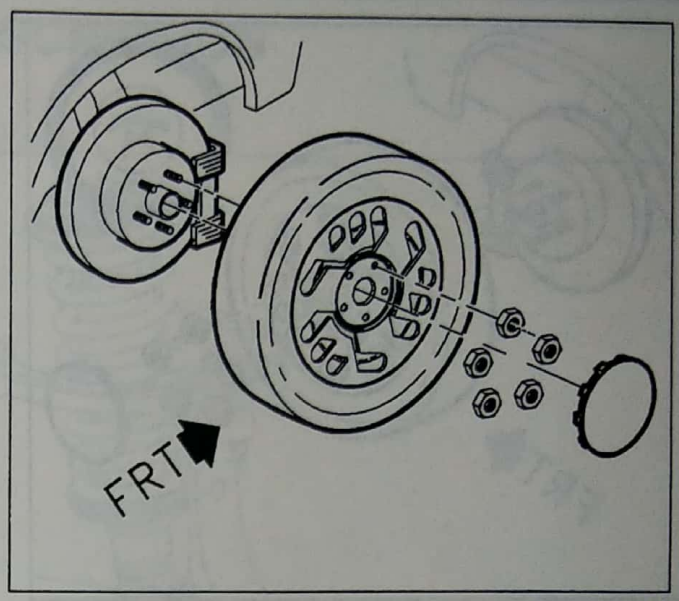
5. Lower vehicle from hoist.

CamScanner

WHEEL STUD REPLACEMENT

REMOVAL AND INSTALLATION

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Remove road wheel.

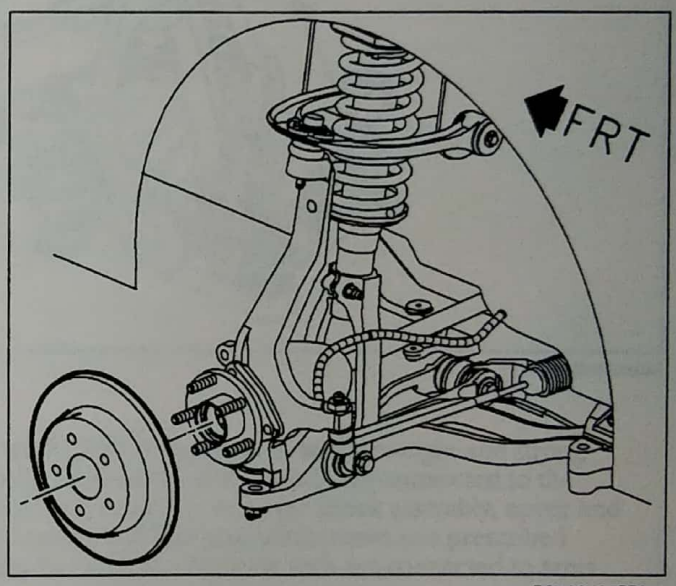


PSMGCH65814AA

3. Remove front caliper and suspend it from the shock spring with safety wire.
4. Remove rotor.
5. Using SA91107NE (or equivalent), remove wheel stud.

IMPORTANT: With stud loose in hub, rotate hub to a position where the least amount of interference between stud and knuckle exists. Remove stud.

6. Start new wheel stud into hub.
7. Place four flat washers onto stud.



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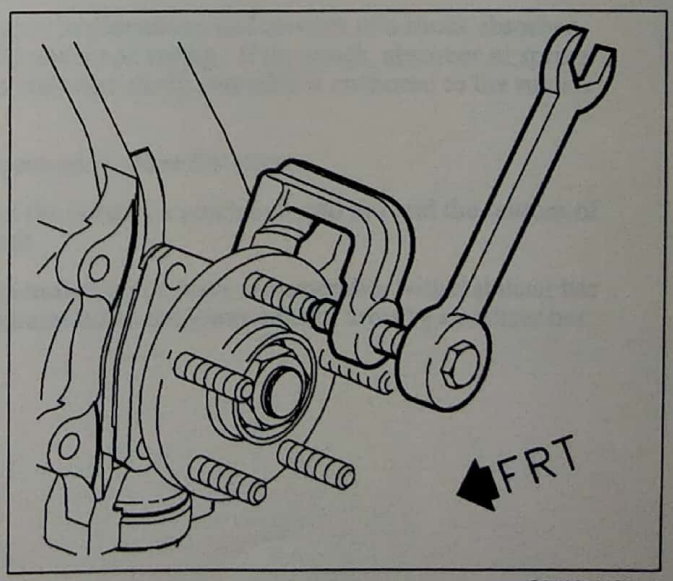
8. Install wheel mounting nut onto stud with flat side of nut towards the washers.
9. Using the proper wrench/socket, tighten nut until stud is fully seated into hub.
10. Install brake rotor onto wheel hub.
11. Install front brake caliper mount bracket onto steering knuckle.

Torque: 110 N•m (81 ft−lbs)

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

12. Position wheel on hub.



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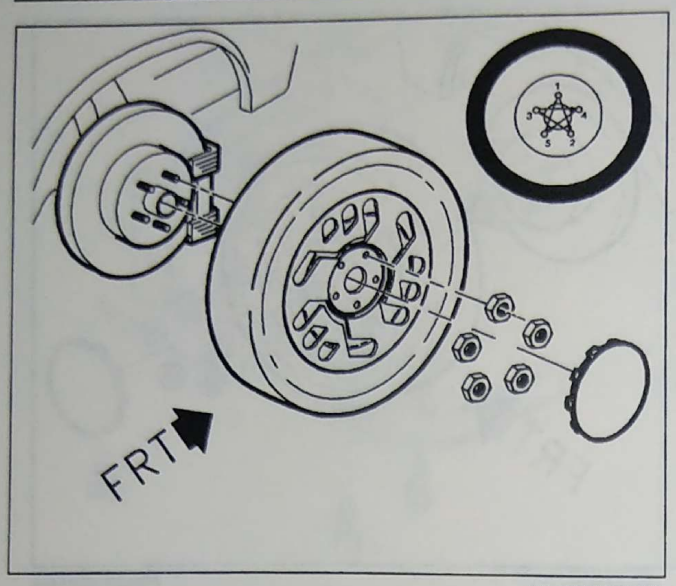


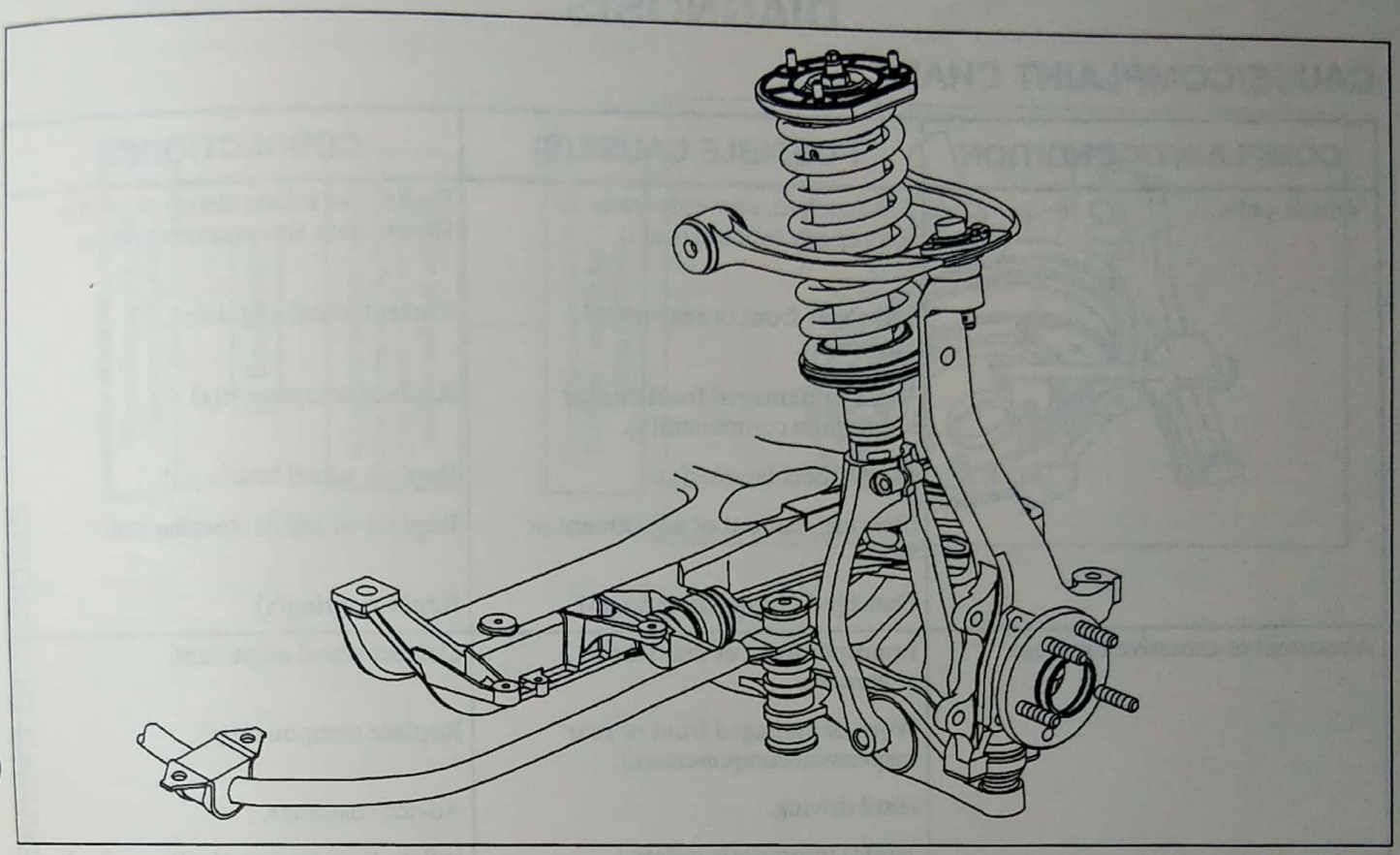
PSMGCH66113AA

13. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

14. Lower vehicle from hoist.

GENERAL DESCRIPTION



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The short/long arm (SLA) independent front suspension used on the EV1 is designed to be lightweight and strong and to offer a comfortable ride while providing excellent handling. Each wheel is independently connected to the cradle/front suspension crossmember by a steering knuckle, wheel hub assembly, coil over shock assembly, upper and lower ball joint and upper and lower control arm. The steering knuckle and hub assemblies move in a prescribed three-dimensional arc. The front wheels are steered by two front tie rods. The front tie rods are connected to arms on the steering knuckle and to the steering gear assembly.

The coil-over-shock assembly provides both spring and shock absorber functions and consists of a shock absorber, lower spring insulator, upper mount, jounce bumper, dust shield and a coil spring . If the shock absorber or spring becomes damaged or worn, it must be serviced separately. The coil-over-shock assembly is anchored to the vehicle at two locations:

(1) The top of the coil-over-shock is fastened to the vehicle structure by three fasteners.

(2) The bottom of the coil-over-shock is attached to the top of the yoke by a pinch bolt and nut and the bottom of the yoke is attached to lower control arm with a nut and bolt.

Vehicle roll is reduced by a stabilizer bar. The stabilizer bar is mounted to the body crossmember with stabilizer bar insulator/clamp assemblies. The ends of the stabilizer bar are connected to the lower control arms by stabilizer bar links with isolating bushings.

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REAR SUSPENSION

DIAGNOSIS

CAUSE/COMPLAINT CHART

COMPLAINT/CONDITION	POSSIBLE CAUSE(S)	CORRECTION(S)
Vehicle pulls	Mismatched, unevenly worn, or improperly inflated tire(s).	Replace or inflate tire(s) correctly. Reset check tire pressure system.
	Improper front or rear wheel alignment.	Correct wheel alignment.
	Worn or damaged front or rear suspension component(s).	Replace component(s).
	Worn wheel bearing(s).	Replace wheel bearing(s).
	Steering gear out of adjustment or worn.	Replace or adjust steering gear.
	Damaged or sagging spring(s).	Replace spring(s).
Abnormal or excessive tire wear	Improper front or rear wheel alignment.	Correct wheel alignment.
	Worn or damaged front or rear suspension components(s).	Replace component(s).
	Hard driving.	Advice customer.
	Tire(s) improperly inflated.	Inflate tire(s) correctly. Reset check tire pressure system.
	Worn shock(s).	Replace worn shock(s).
Excessive body roll/pitching	Shocks bent or broken.	Replace shocks.
	Broken or sagging spring(s).	Replace damaged spring(s).
	Tire(s) improperly inflated.	Inflate tire(s) correctly. Reset check tire pressure system.
	Shock(s) worn.	Replace worn shock(s).

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Wheel Bearing Assembly Noise Diagnosis

If a Road Test indicates noise, it could be wheels, bearings or tires, check the following.

1. Check tires for proper pressure and uneven wear. Reset check tire pressure system.
2. Raise vehicle on a hoist and spin wheels; check for out−of−round tires, out−of−balance tires, bent rims, loose wheel nuts, loose and/or rough wheel bearings.

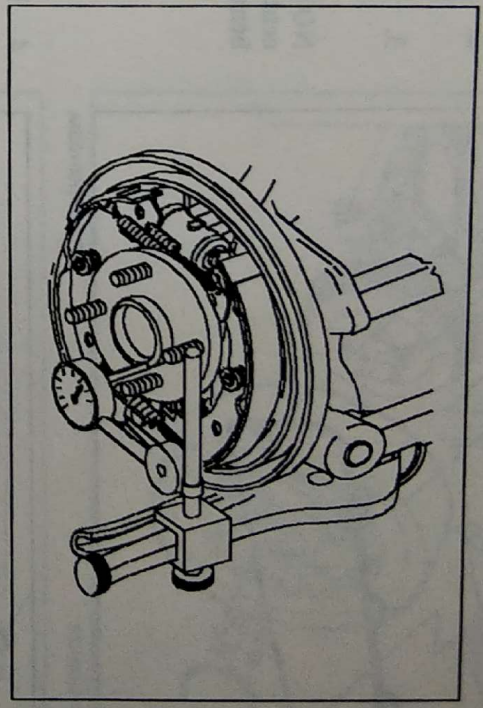
- Suspect bearing noise.
  - Rear wheel bearing assembly.
  - Hoist vehicle. Spin wheel with wheel spinner.
    - Noise or roughness can be heard from driver's seat.
      - Replace hub and bearing assembly.
    - Noise or roughness cannot be heard.
      - Noise is not wheel bearing assembly.
- Other noise. (Correct as required.)

Wheel Bearing Assembly Looseness Diagnosis

Drum Brake

Mount dial indicator as shown below. Grasp bearing flange and using a push−pull movement, note the indicator readings.

If looseness exceeds 0.130 mm (0.005 in.), replace hub and bearing assembly.



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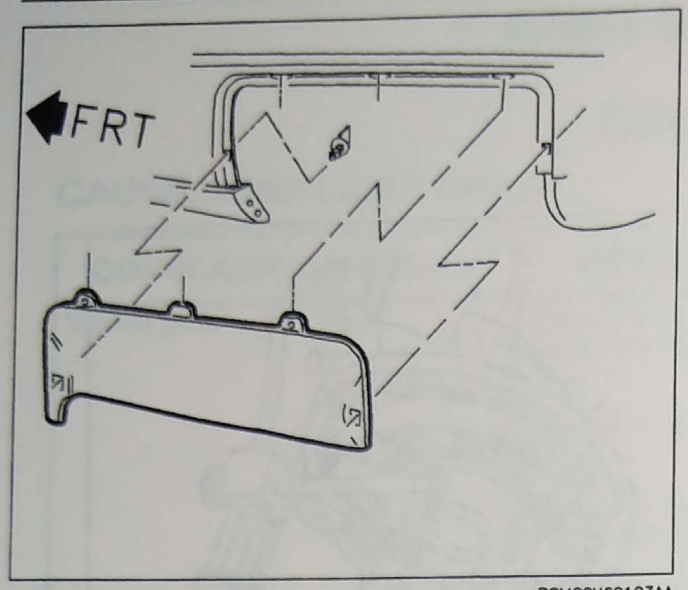


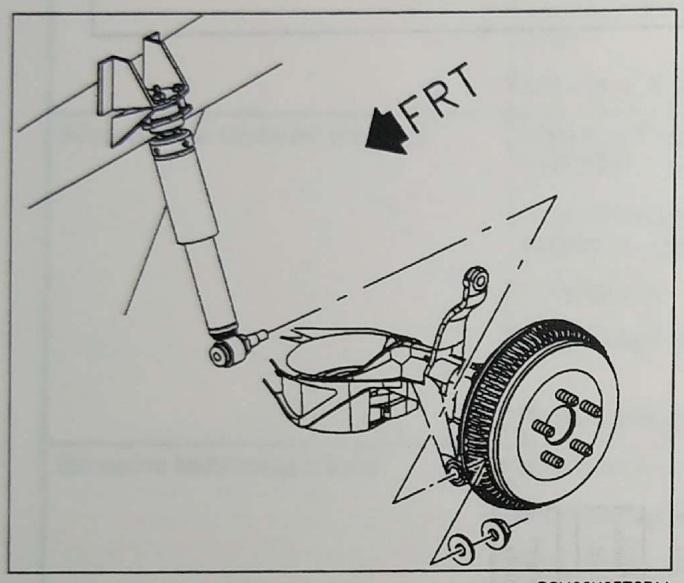
PSMGCH60103AA

REAR SHOCK

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Remove rear wheel opening cover and remove rear road wheel.
3. Support rear axle assembly below spring cups, both sides.

NOTICE: Do not support rear axle assembly in the center only. This may cause the rear axle assembly to bend.

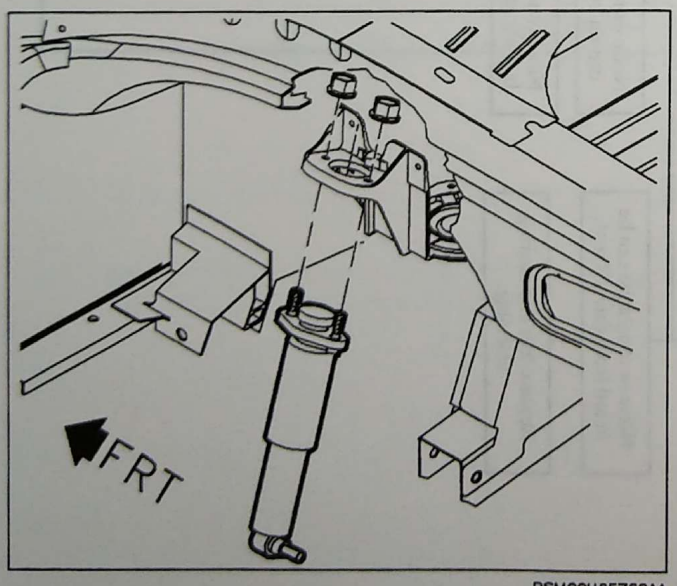


PSMGCH65763AA

4. Disconnect rear shock from axle.

IMPORTANT: If difficulty is encountered separating shock from rear axle, install shock nut onto shock stud with flat side of nut facing rearward. Tap on flat side of nut using a plastic hammer. Do not hammer directly on shock stud.

5. Disconnect rear shock from body structure.



PSMGCH65762AA

INSTALLATION

1. Attach rear shock to body structure.

Torque: 25 N•m (18 ft−lbs)

2. Attach rear shock to axle assembly.

Torque: 60 N•m (44 ft−lbs)

3. Remove rear axle supports from under spring cups.

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

4. Position wheel on hub.

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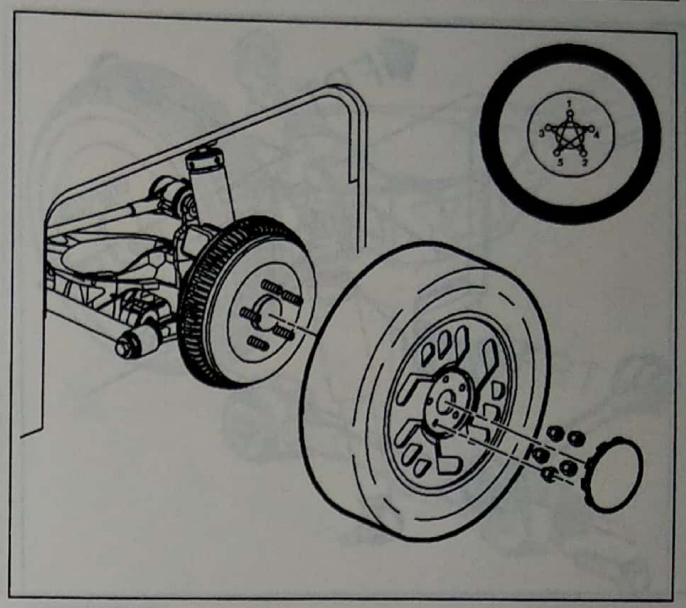
5. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

6. Install rear wheel opening cover and lower vehicle from hoist.



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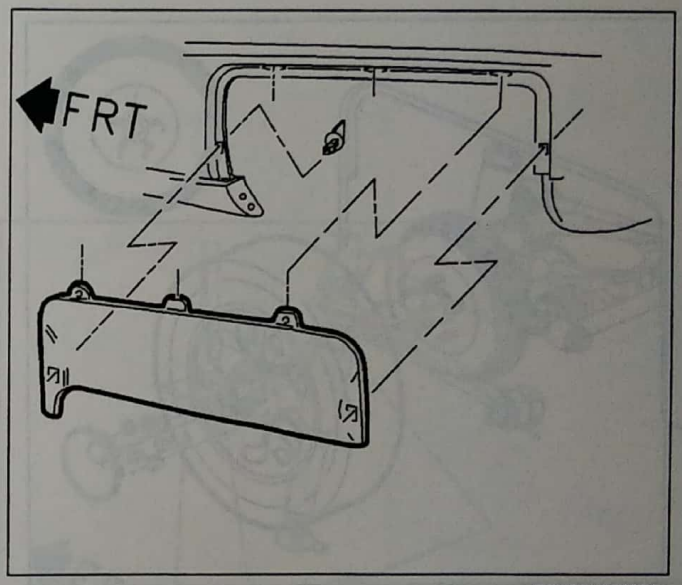
REAR SUSPENSION UPPER LINK

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)



PSMGCH60103AA

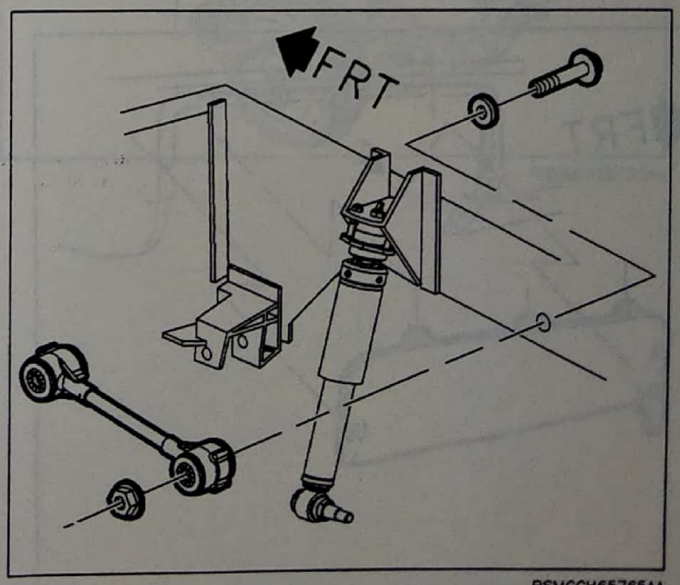
2. Remove rear wheel opening cover and remove rear road wheel.
3. Support rear axle assembly below spring cups, both sides.

NOTICE: Do not support rear axle assembly in the center only. This may cause the rear axle assembly to bend.

4. Remove bolt and nut securing rear upper link to body structure.

IMPORTANT: To access bolt, open rear compartment lid and remove cargo net retainers and lift carpet.

5. Remove bolt and nut attaching rear upper link to rear axle.
6. Remove rear upper link from vehicle.



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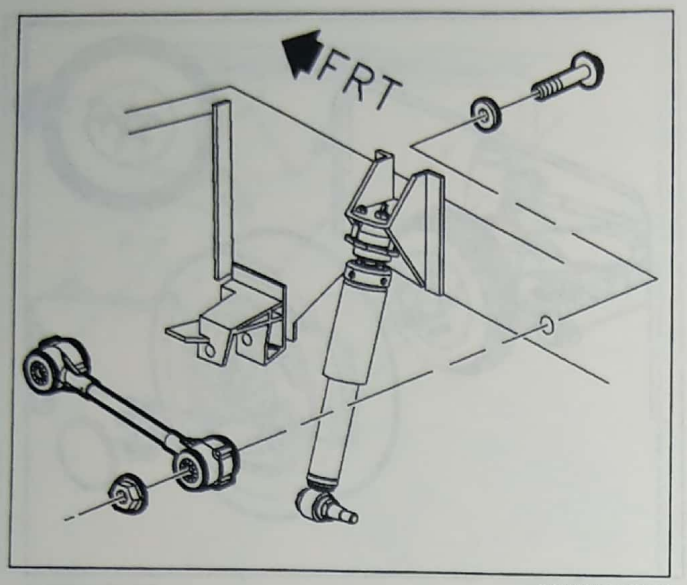


PSMGCH65765AA

INSTALLATION

1. Attach rear upper link to body structure. Do not tighten at this time.
2. Attach rear upper link to rear axle and tighten nut.

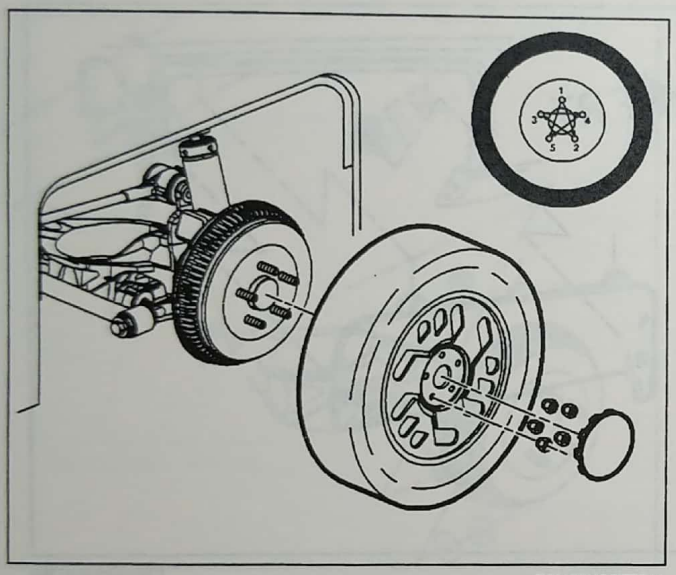
Torque: 75 N•m (55 ft−lbs)

IMPORTANT: Suspension must be preloaded (road height) at curb weight before tightening rear upper suspension link.

3. Tighten nut securing rear upper suspension link to body structure.

Torque: 75 N•m (55 ft−lbs)

4. Remove rear axle supports from under spring cups.

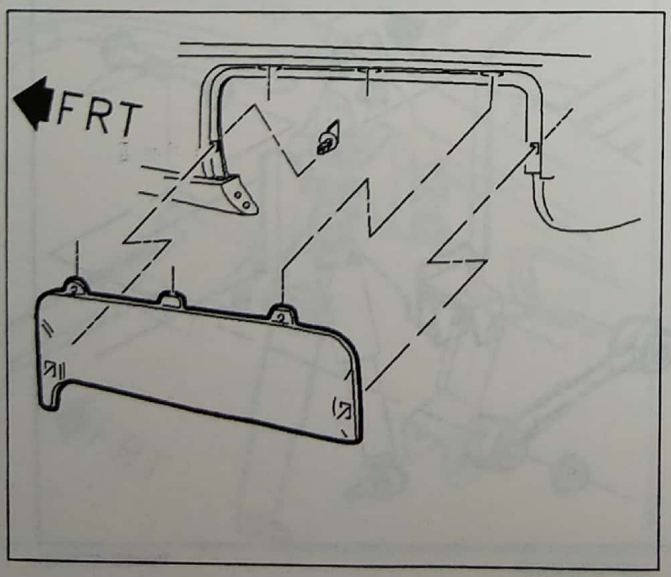


PSMGCH66735AA

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.

5. Position wheel on hub.
6. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)



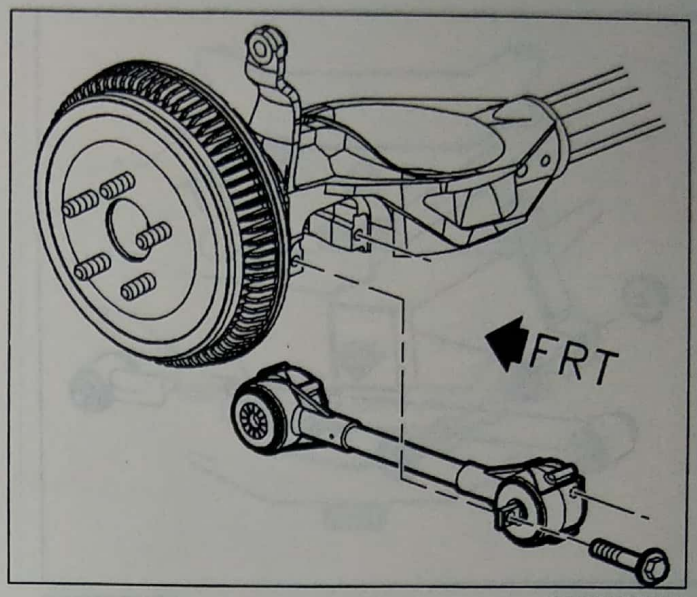
PSMGCH60103AA

7. Install rear wheel opening cover and lower vehicle from hoist.

REAR SUSPENSION LOWER LINK

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Support rear axle assembly below spring cups, both sides.
3. Remove fasteners attaching rear lower suspension link to axle.



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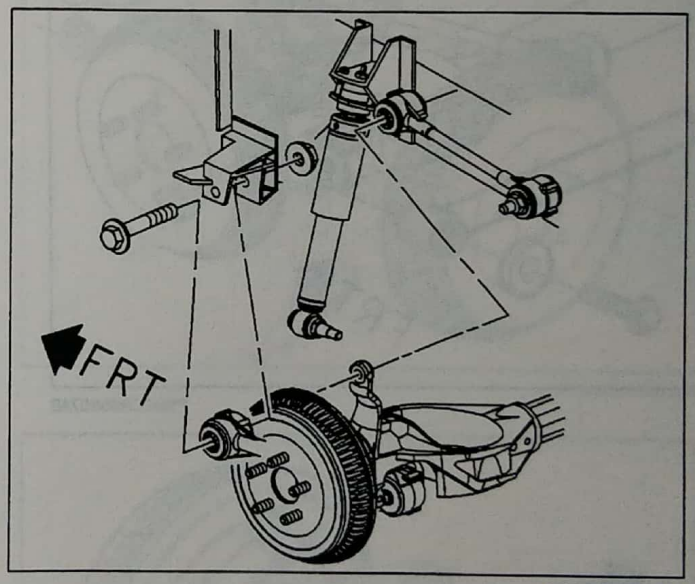
4. Remove fastener attaching rear lower suspension link to body.
5. Remove rear lower suspension link from vehicle.



PSMGCH66028AA

INSTALLATION

1. Attach rear lower suspension link to body. Do not tighten fastener at this time.
2. Attach rear lower suspension link to rear axle.

Torque: 75 N•m (55 ft−lbs)

IMPORTANT: Suspension must be preloaded (road height) at curb weight before tightening rear lower suspension link.

3. Tighten nut securing rear lower suspension link to body.

Torque: 80 N•m (59 ft−lbs)

4. Remove rear axle supports from under spring cups and lower vehicle from hoist.

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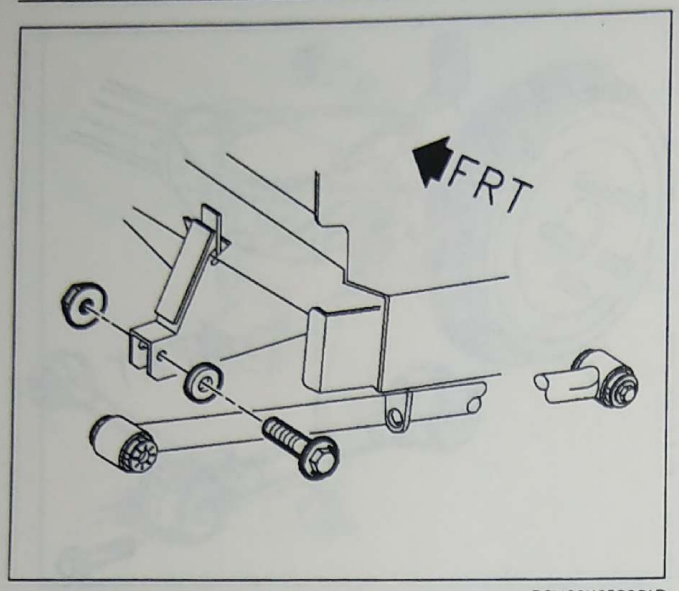

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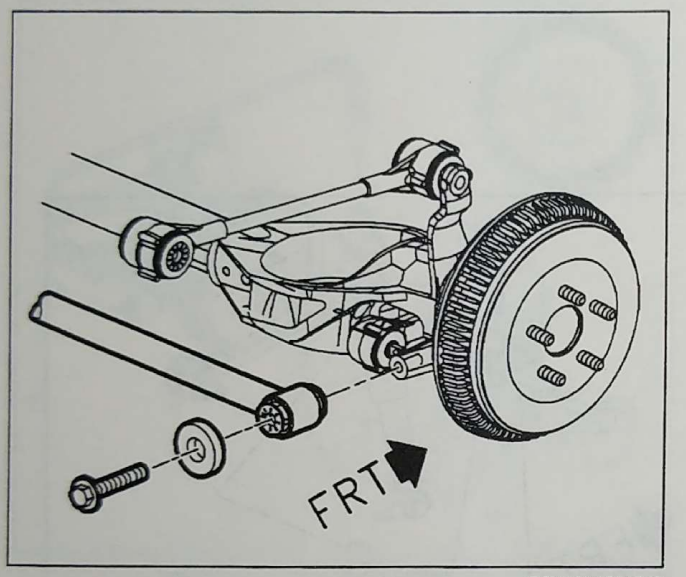

PSMGCH65807AB

REAR TRACK BAR

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Support rear axle assembly below spring cups, both sides.
3. Remove fastener attaching rear track bar to body.
4. Remove fastener attaching rear track bar to axle.
5. Remove rear track bar from vehicle.

INSTALLATION

1. Attach track bar to rear axle.

Torque: 200 N•m (148 ft−lbs)

2. Attach track bar to body. Do not tighten fastener at this time.

IMPORTANT: Suspension must be preloaded (road height) at curb weight before tightening rear track bar to body.

3. Tighten nut attaching track bar to body.

Torque: 75 N•m (55 ft−lbs)

4. Remove rear axle supports from under spring cups.
5. Lower vehicle from hoist.

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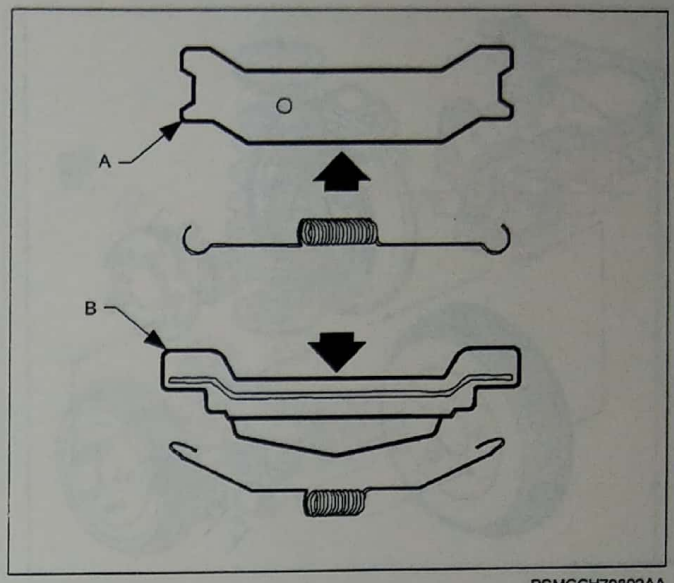
REAR AXLE ASSEMBLY

REMOVAL

1. Release park brake.
   a. Place keypad in **OFF** mode.
   b. Depress brake pedal.
   c. While brake pedal is depressed, push park brake apply/release button.
2. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
3. Remove rear wheel opening cover and remove road wheel from hub being serviced.



PSMGCH70802AA

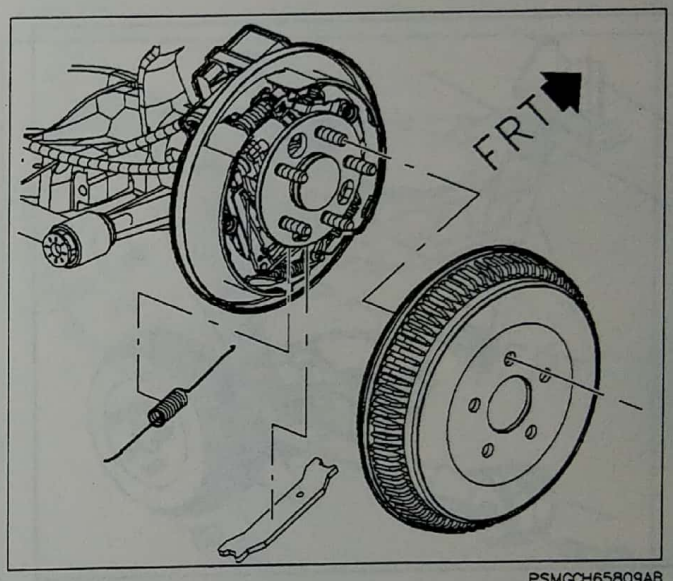
4. Remove brake drum.

NOTICE: Release park brake.

IMPORTANT: If vehicle is equipped with a first design rear drum brake assembly with a straight strut and strut spring (A), go to step 5. If equipped with a second design rear drum brake assembly with a offset strut and spring (B), go to step 6. Arrow in illustration indicates this side out.

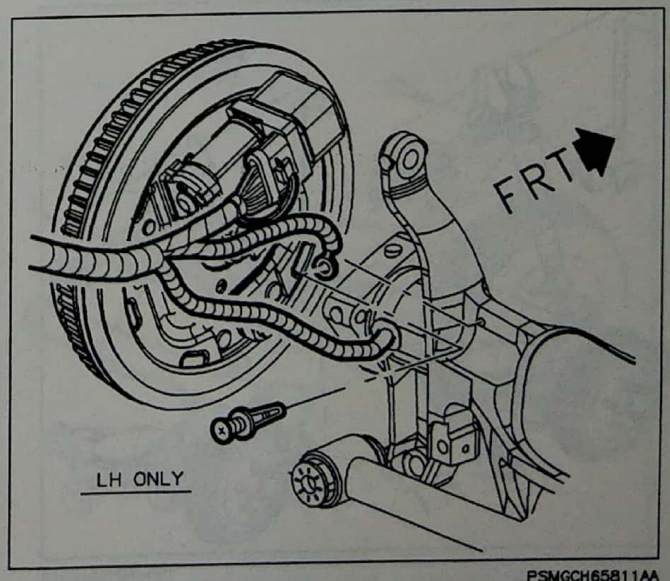
NOTICE: Do not apply brake pedal or parking brake with rear drum removed. This may damage brake actuator assembly.

5. Remove rear brake assembly strut lever and return spring.



PSMGCH65809AB

6. Disconnect electrical connections from rear brake motor.
7. Remove four fasteners securing rear hub assembly to rear axle.
8. Separate hub assembly from rear brake backing plate.
9. Carefully pull complete assembly away from axle and disconnect electrical connector for the wheel speed sensor.



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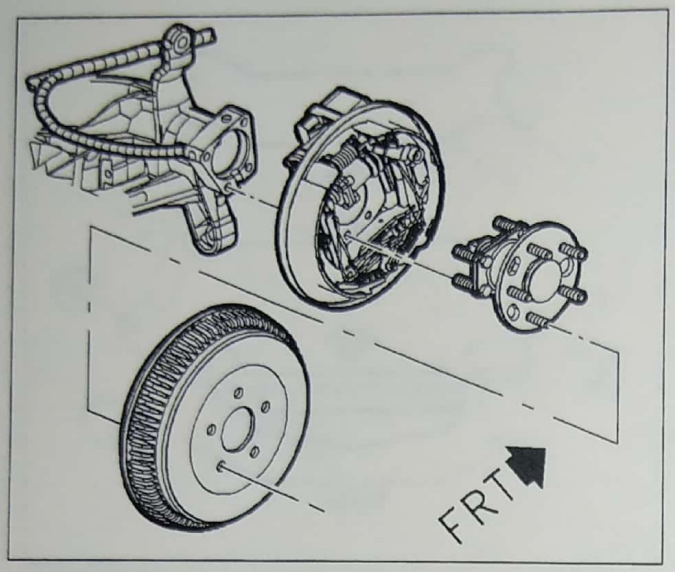

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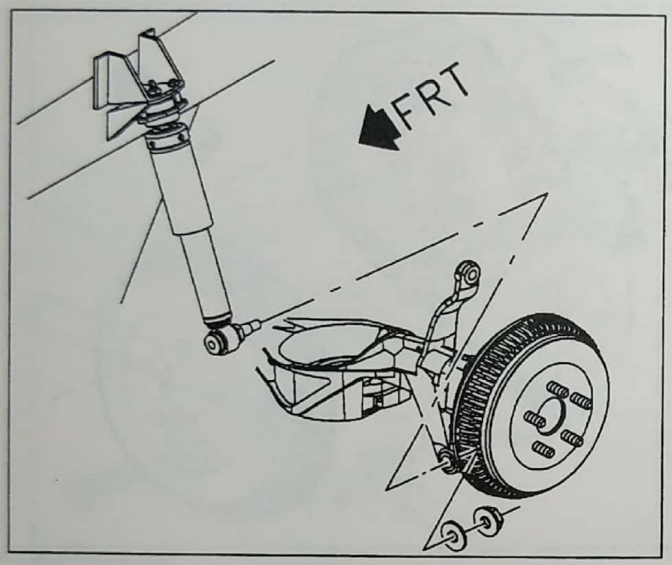
10. Remove hub assembly from vehicle.
11. Repeat steps 3 thru 10 for opposite side.



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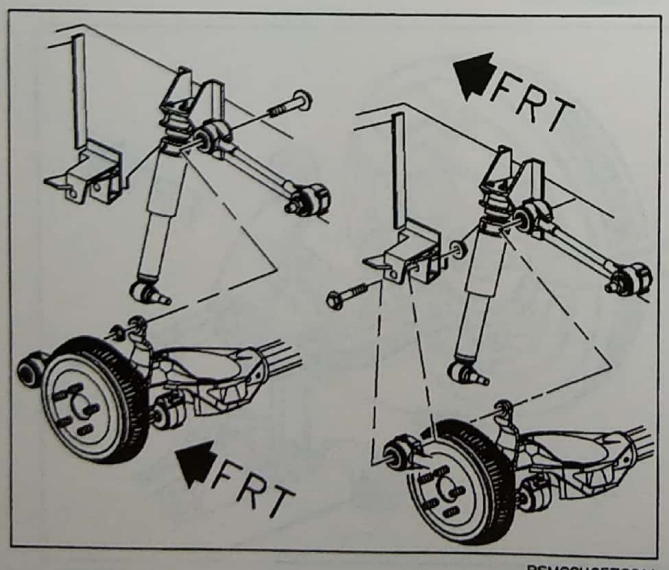
12. Support rear axle assembly below spring cups, both sides.
13. Disconnect all electrical connections and grounds from the rear brakes at the rear axle location.
14. Disconnect rear shocks from rear axle assembly.

IMPORTANT: If difficulty is encountered separating shock from rear axle, install shock nut onto shock stud with flat side of nut facing rearward. Tap on flat side of nut using a plastic hammer. Do not hammer directly on shock stud.

15. Disconnect rear upper suspension links from axle.



PSMGCH65766AA

16. Disconnect rear track bar from axle.
17. Disconnect rear lower suspension links from axle.

CAUTION: FAILURE TO SUPPORT REAR AXLE CAN CAUSE REAR AXLE TO DROP TO THE GROUND WHEN REAR AXLE IS DISCONNECT FROM REAR SUSPENSION LINKS.

CAUTION: SUPPORT THE FRONT OF THE VEHICLE TO ENSURE THAT THE VEHICLE WILL NOT BECOME UNBALANCED AND TIP FORWARD, OFF THE HOIST, ONCE THE REAR AXLE IS REMOVED (DUE TO DECREASED PROPORTION OF THE REAR MASS). FAILURE TO SUPPORT FRONT OF VEHICLE COULD CAUSE VEHICLE TO FALL OFF HOIST.

18. Using axle support listed in step 12 above, carefully lower rear axle to the point where tension is removed from rear springs.
19. Remove rear springs from vehicle.
20. Lower rear axle from vehicle.

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INSTALLATION

1. Raise rear axle to the position where lower suspension links can be attached.
2. Attach rear lower suspension links to axle.

Torque: 75 N•m (55 ft−lbs)

3. Install lower rear spring insulators into axle.

NOTICE: Orient insulators as shown in illustration.

4. Install rear springs with upper insulators into spring pockets of rear axle.

NOTICE: Align end of rear spring coil to stop on insulator.

5. Raise rear axle to the point where upper suspension links can be attached.
6. Attach upper suspension links to axle. Do not tighten fastener at this time.
7. Attach rear shocks to axle.

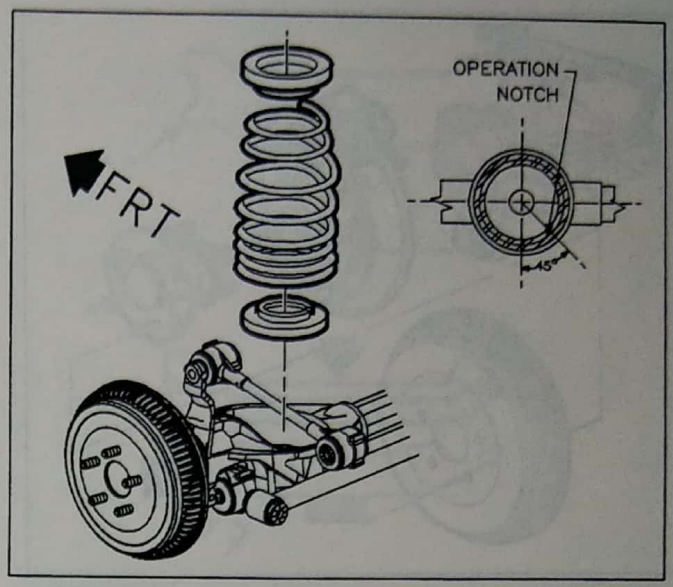
Torque: 60 N•m (44 ft−lbs)

8. Attach rear track bar to axle. Do not tighten fastener at this time.
9. Connect all electrical connections and grounds.

IMPORTANT: Suspension must be preloaded (road height) at curb weight before tightening fasteners.

10. Tighten nuts for rear upper suspension links to axle.

Torque: 75 N•m (55 ft−lbs)



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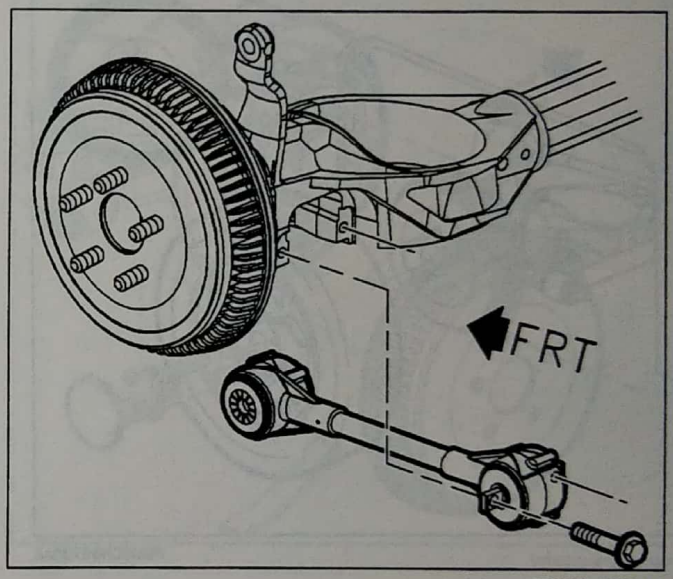
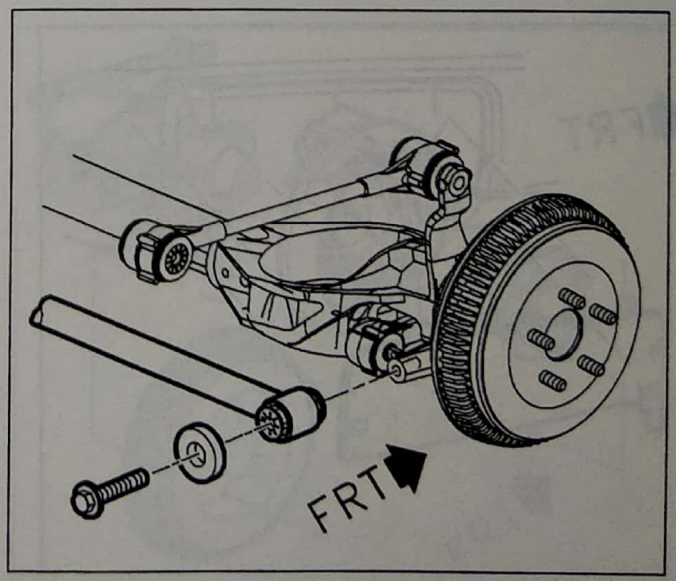


PSMGCH65764AA

11. Tighten fastener for rear track bar to axle.

Torque: 200 N•m (148 ft−lbs)



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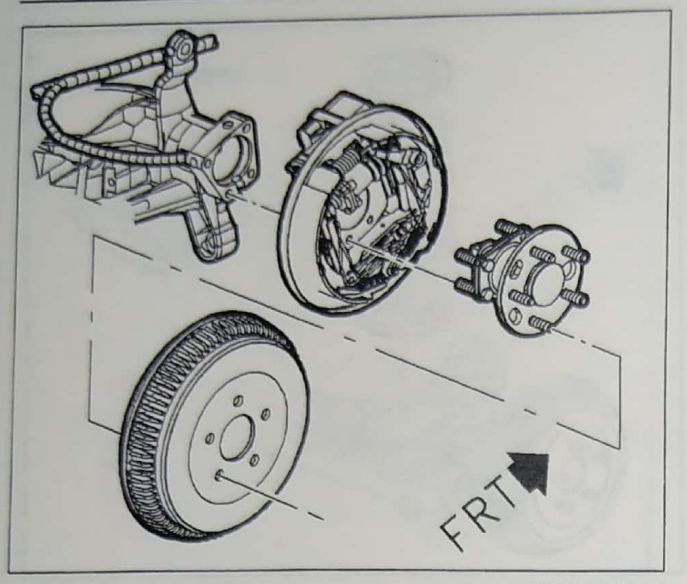

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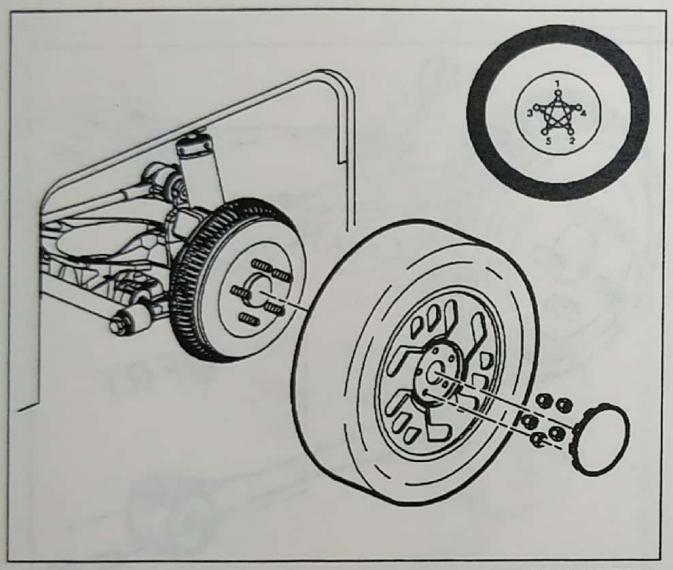

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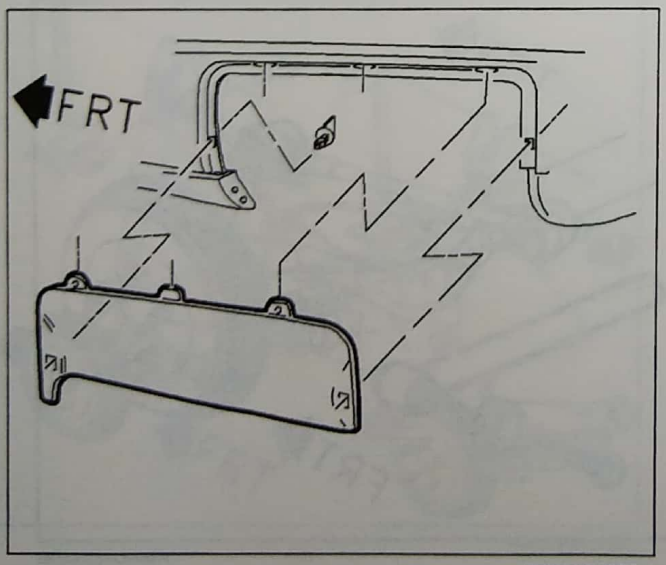


PSMGCH60103AA

12. Connect rear wheel speed sensor connector to harness.
13. Install rear hub assemble through rear brake assembly and backing plate.
14. Secure rear hub assembly to rear axle with four fasteners and tighten bolts using a flank drive socket.

Torque: 70 N•m (52 ft−lbs)

IMPORTANT: If vehicle is equipped with a first design rear drum brake assembly with a straight strut and strut spring, go to step 15. If equipped with a second design rear drum brake assembly with a offset strut and spring, go to step 16.

15. Install rear brake assembly strut lever and return spring.
16. Connect all electrical connectors for rear brake motor.
17. Install rear brake drum.

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake drums. Failure to do so can cause wheel lug nuts to loosen in service.

18. Position wheel on hub.
19. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

20. Install rear wheel opening cover and lower vehicle from hoist.
21. Repeat steps 12 thru 20 for opposite side.

REAR COIL SPRING

REMOVAL

1. Release park brake.
   a. Place keypad in **OFF** mode.
   b. Depress brake pedal.
   c. While brake pedal is depressed, push park brake apply/release button.

CAUTION: MAKE SURE VEHICLE IS PROPERLY SUPPORTED AND SQUARELY POSITIONED ON HOIST. TO HELP AVOID PERSONAL INJURY, PROVIDE ADDITIONAL SUPPORT TO THE OPPOSITE END OF THE VEHICLE THAT COMPONENTS WILL BE REMOVED FROM.

2. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
3. Remove rear wheel opening cover and remove road wheel from hub being serviced.

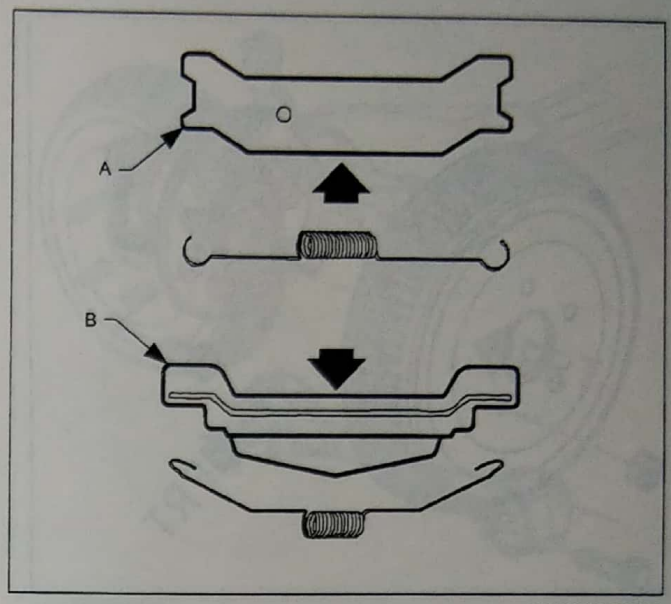
NOTICE: Release park brake.

4. Remove brake drum.

NOTICE: Do not apply brake pedal or parking brake with rear drum removed. This may damage brake actuator assembly.

IMPORTANT: If vehicle is equipped with a first design rear drum brake assembly with a straight strut and strut spring (A), go to step 5. If equipped with a second design rear drum brake assembly with a offset strut and spring (B), go to step 6. Arrow in illustration indicates this side out.

5. Remove rear brake assembly strut lever and return spring.



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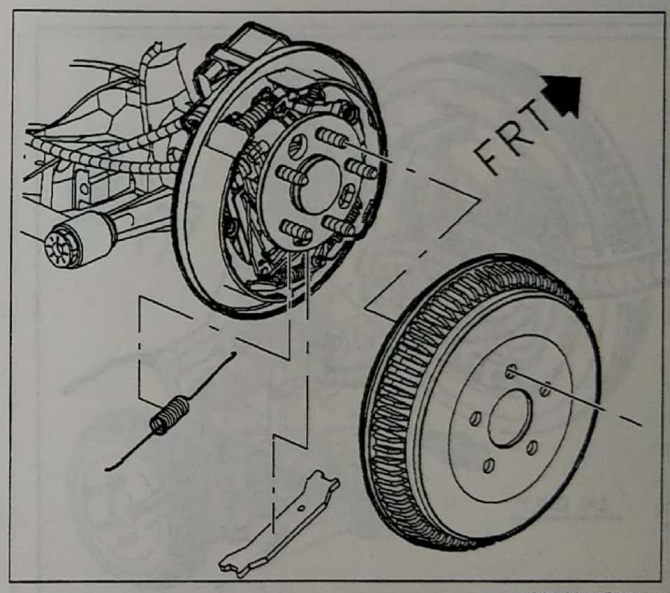
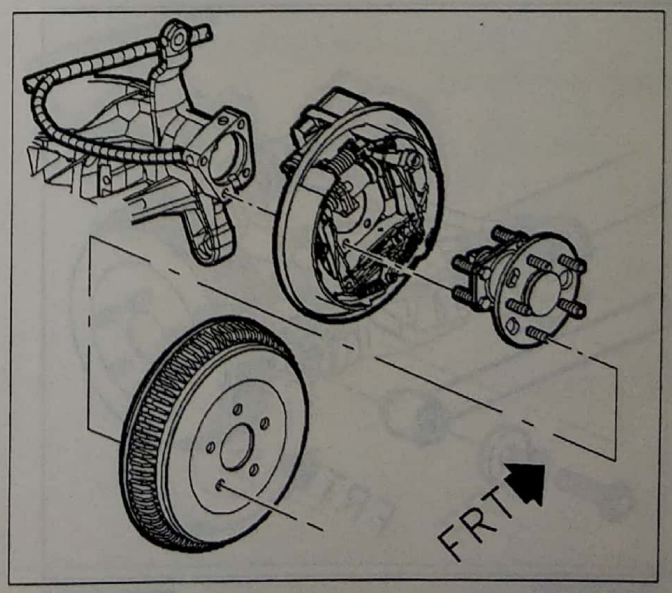


PSMGCH65809AB

6. Disconnect electrical connections from rear brake motor.
7. Remove four fasteners securing rear hub assembly to rear axle.
8. Separate hub assembly from rear brake backing plate.
9. Carefully pull complete assembly away from axle and disconnect electrical connector for the wheel speed sensor.



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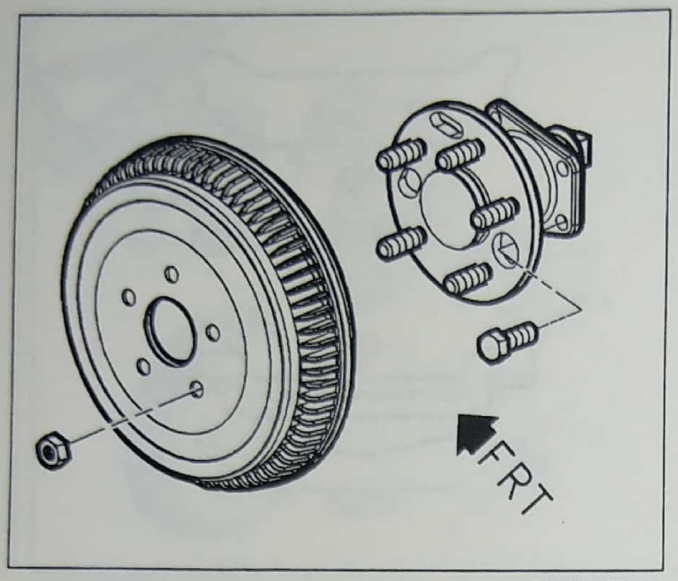

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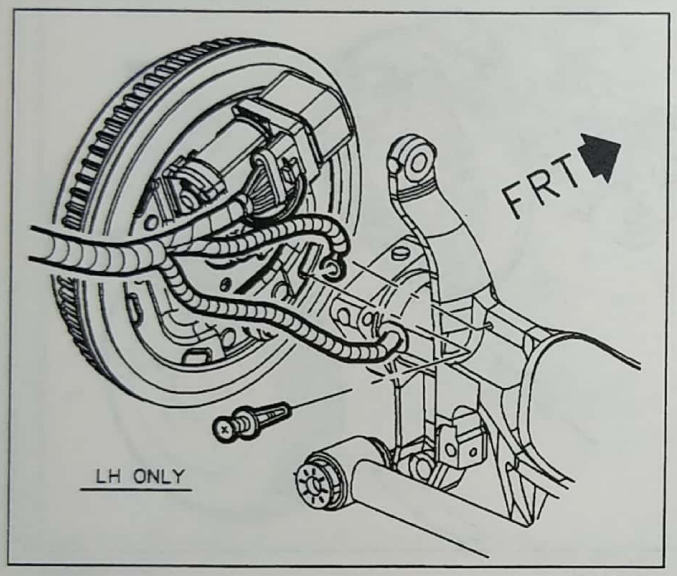
10. Remove hub assembly from vehicle.
11. Repeat steps 3 thru 10 for opposite side



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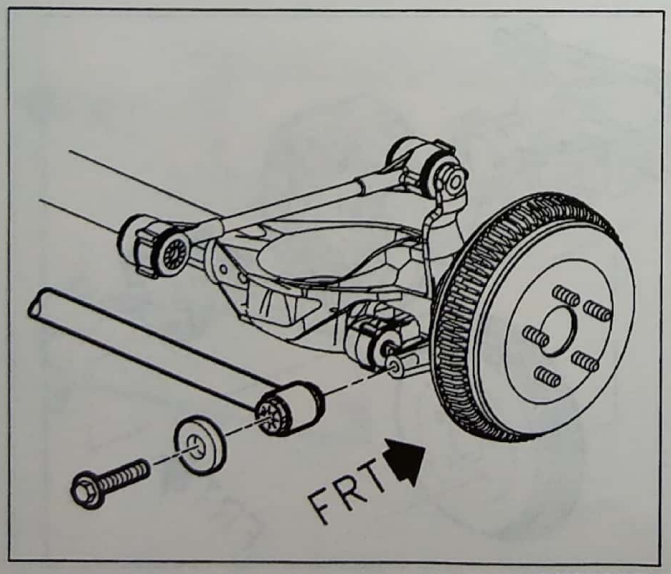
12. Support rear axle assembly below spring cups, both sides.
13. Disconnect all electrical connections and grounds from the rear brakes at the rear axle location.
14. Disconnect rear shocks from rear axle assembly.
15. Disconnect rear upper suspension links from axle.



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16. Disconnect rear track bar from axle.
17. Disconnect rear lower suspension links from axle.

CAUTION: FAILURE TO SUPPORT REAR AXLE CAN CAUSE REAR AXLE TO DROP TO THE GROUND WHEN REAR AXLE IS DISCONNECT FROM REAR SUSPENSION LINKS.

CAUTION: SUPPORT THE FRONT OF THE VEHICLE TO ENSURE THAT THE VEHICLE WILL NOT BECOME UNBALANCED AND TIP FORWARD, OFF THE HOIST, ONCE THE REAR AXLE IS REMOVED (DUE TO DECREASED PROPORTION OF THE REAR MASS). FAILURE TO SUPPORT FRONT OF VEHICLE COULD CAUSE VEHICLE TO FALL OFF HOIST.

18. Using axle support listed in step 12 above, carefully lower rear axle to the point where tension is removed from rear springs.
19. Remove rear springs from vehicle.

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INSTALLATION

1. Raise rear axle to the position where lower suspension links can be attached.
2. Attach rear lower suspension links to axle.

Torque: 75 N•m (55 ft−lbs)

3. Install lower rear spring insulators into axle.

NOTICE: Orient insulator as shown in illustration.

4. Install rear springs with upper insulators into spring pockets of rear axle.

NOTICE: Align end of rear spring coil to stop on insulator.

5. Raise rear axle to the point where upper suspension links can be attached.
6. Attach upper suspension links to axle. Do not tighten fasteners at this time.
7. Attach rear shocks to axle.

Torque: 60 N•m (44 ft−lbs)

8. Attach rear track bar to axle. Do not tighten fastener at this time.
9. Connect all electrical connections and grounds.

IMPORTANT: Suspension must be preloaded (road height) at curb weight before tightening fasteners.

10. Tighten nuts for rear upper suspension links to axle.

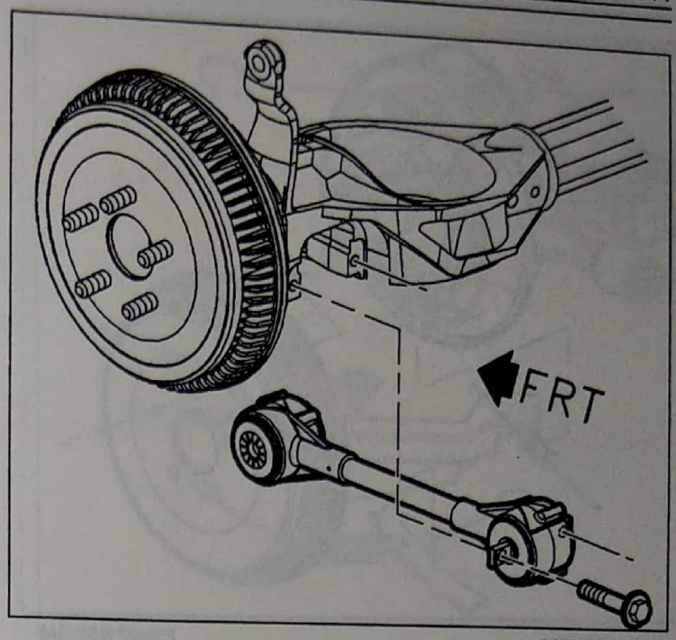
Torque: 75 N•m (55 ft−lbs)

11. Tighten fastener for rear track bar to axle.

Torque: 200 N•m (148 ft−lbs)

12. Connect rear wheel speed sensor connector to harness.
13. Install rear hub assemble through rear brake assembly and backing plate.
14. Secure rear hub assembly to rear axle with four fasteners and tighten bolts using a flank drive socket.

Torque: 70 N•m (52 ft−lbs)



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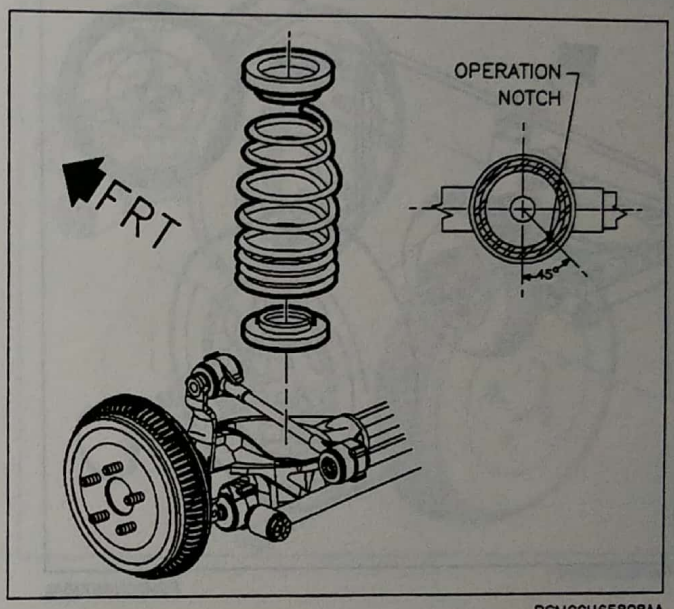

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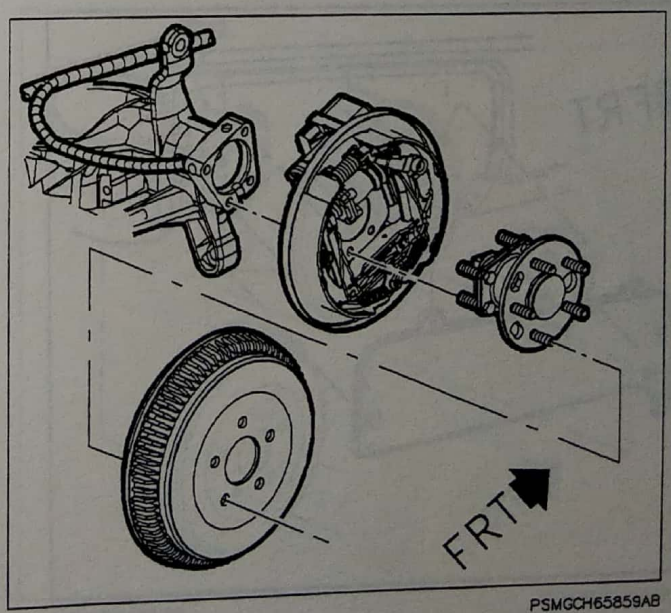

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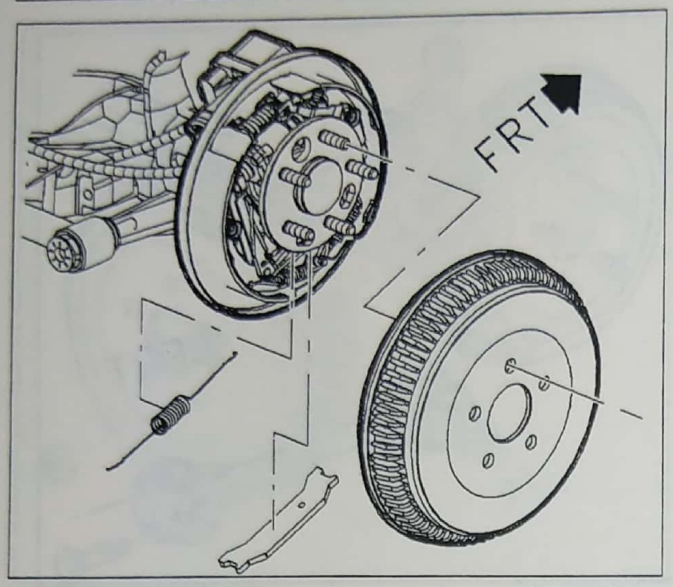

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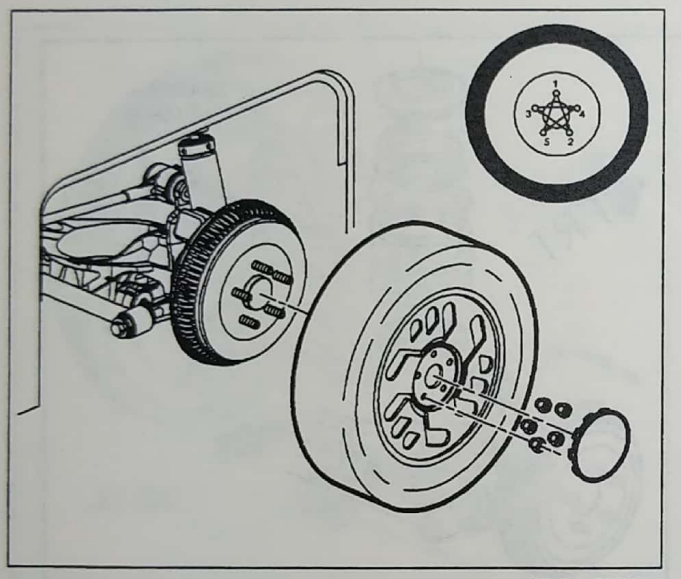
IMPORTANT: If vehicle is equipped with a first design rear drum brake assembly with a straight strut and strut spring, go to step 15. If equipped with a second design rear drum brake assembly with a offset strut and spring, go to step 16.

15. Install rear brake assembly strut lever and return spring.
16. Connect all electrical connectors for rear brake motor.
17. Install rear brake drum.

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake drums. Failure to do so can cause wheel lug nuts to loosen in service.

18. Position wheel on hub.



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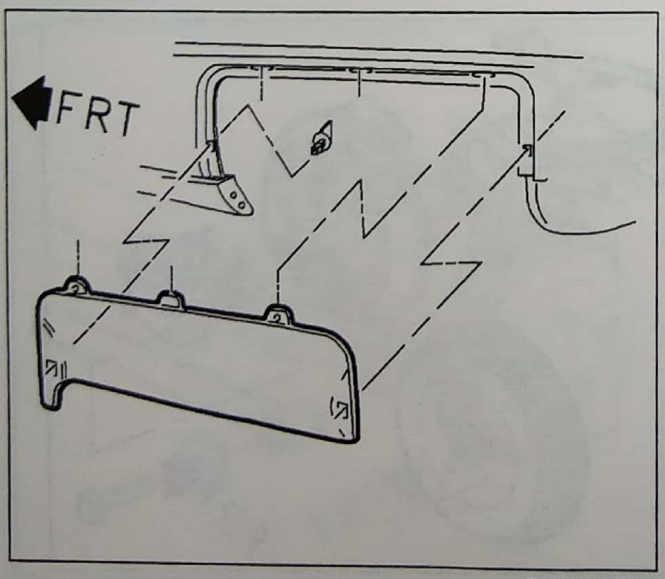
19. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)



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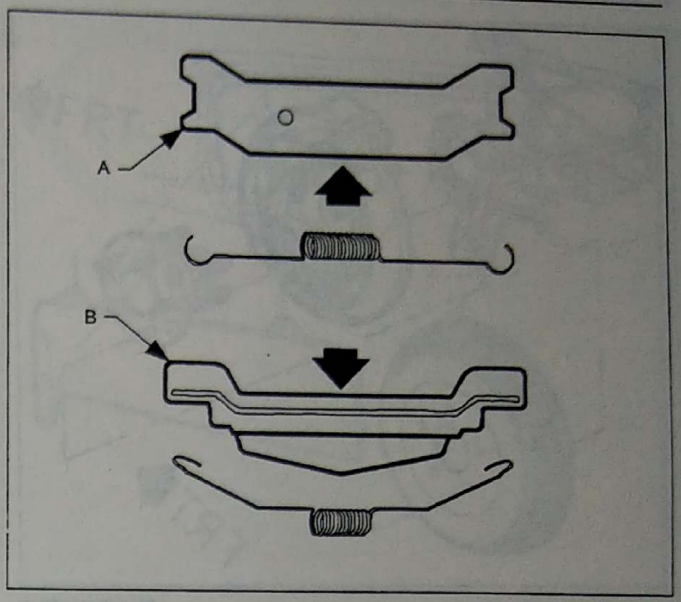
20. Install rear wheel opening cover and lower vehicle from hoist.
21. Repeat steps 12 thru 20 for opposite side.

REAR WHEEL HUB

REMOVAL

1. Release park brake.
   a. Place keypad in **OFF** mode.
   b. Depress brake pedal.
   c. While brake pedal is depressed, push park brake apply/release button.
2. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual)
3. Remove rear wheel opening cover.



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4. Remove road wheel from hub being serviced.

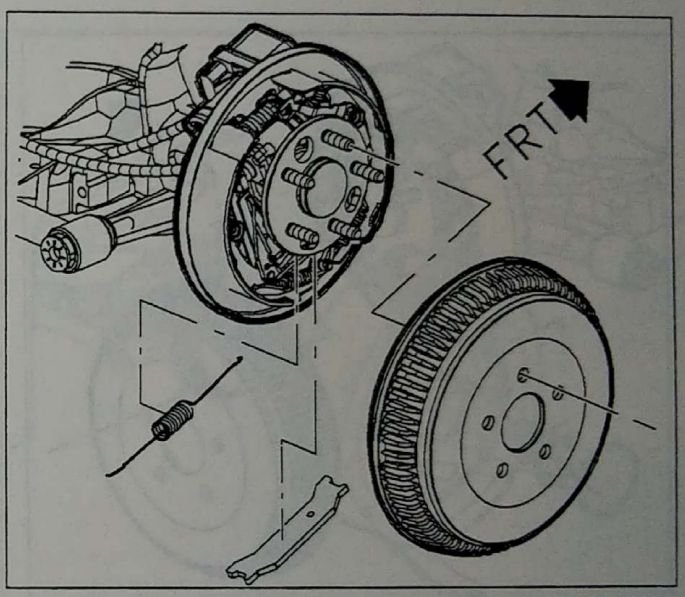
NOTICE: **Release park brake.**

5. Remove brake drum.

NOTICE: **Do not apply brake pedal or parking brake with rear drum removed. This may damage brake actuator assembly.**

IMPORTANT: If vehicle is equipped with a first design rear drum brake assembly with a straight strut and strut spring (A), go to step 6. If equipped with a second design rear drum brake assembly with a offset strut and spring (B), go to step 7. Arrow in illustration indicates this side out.

6. Remove rear brake assembly strut lever and return spring.



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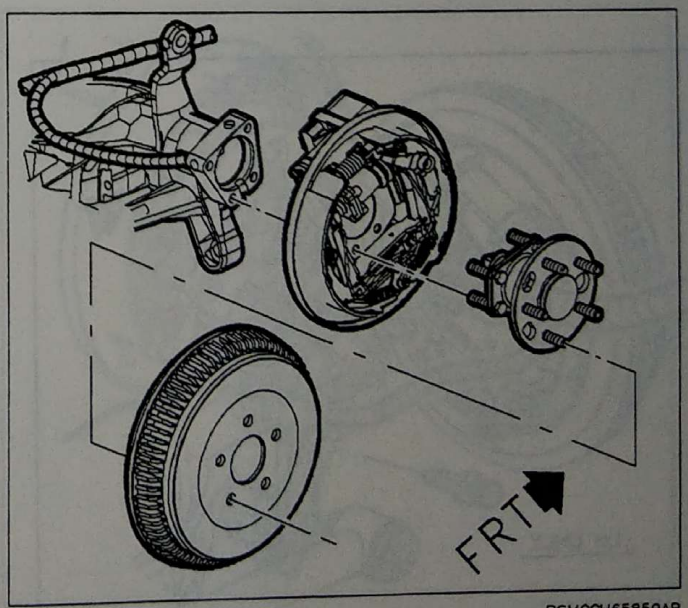
7. Disconnect electrical connections from rear brake motor.
8. Remove four fasteners securing rear hub assembly to rear axle.
9. Separate hub assembly from rear brake backing plate.
10. Carefully pull complete assembly away from axle and disconnect electrical connector for the wheel speed sensor.



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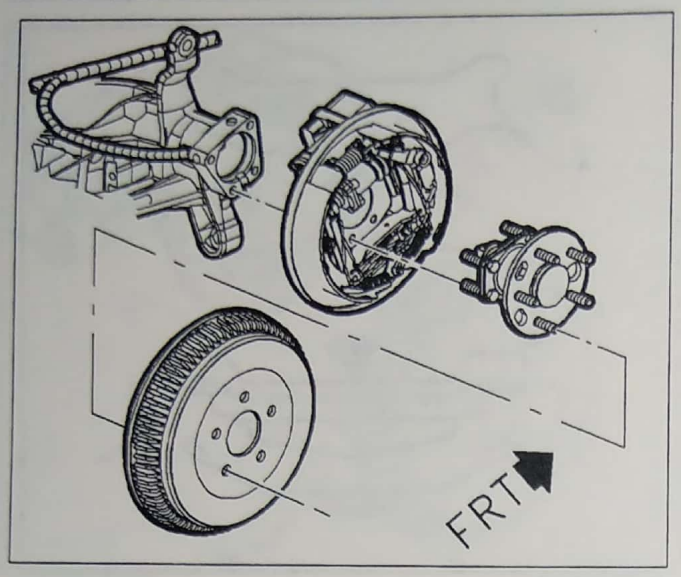

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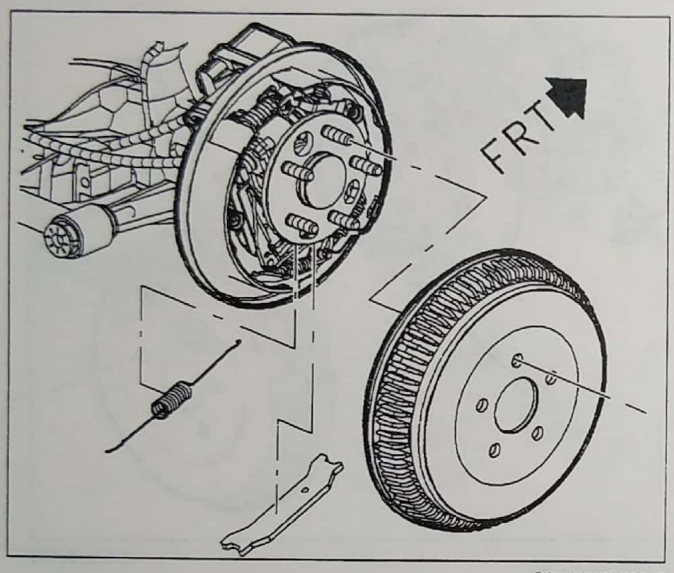
11. Remove hub assembly from vehicle.



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INSTALLATION

1. Connect rear wheel speed sensor connector to harness.
2. Install rear hub assemble through rear brake assembly and backing plate.
3. Secure rear hub assembly to rear axle with four fasteners and tighten bolts using a flank drive socket.

Torque: 70 N•m (52 ft−lbs)

IMPORTANT: If vehicle is equipped with a first design rear drum brake assembly with a straight strut and strut spring, go to step 4. If equipped with a second design rear drum brake assembly with a offset strut and spring, go to step 5.

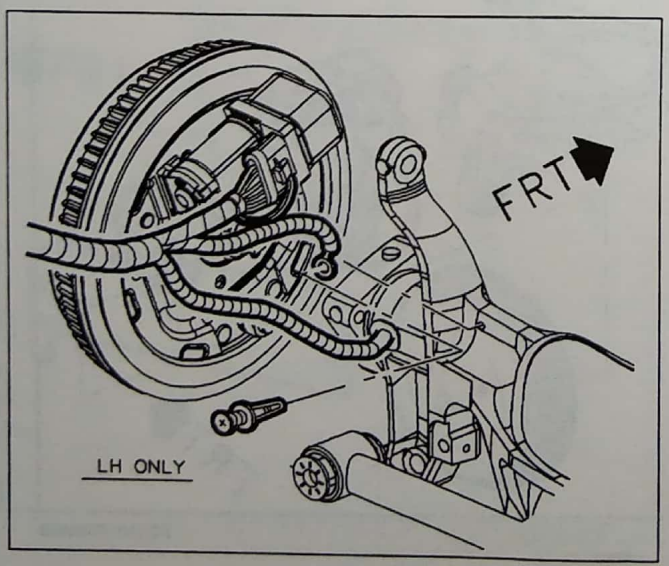
4. Install rear brake assembly strut lever and return spring.
5. Connect all electrical connectors for rear brake motor.
6. Install rear brake drum.

NOTICE: Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake drums. Failure to do so can cause wheel lug nuts to loosen in service.

7. Position wheel on hub.
8. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)

9. Install rear wheel opening cover and lower vehicle from hoist.



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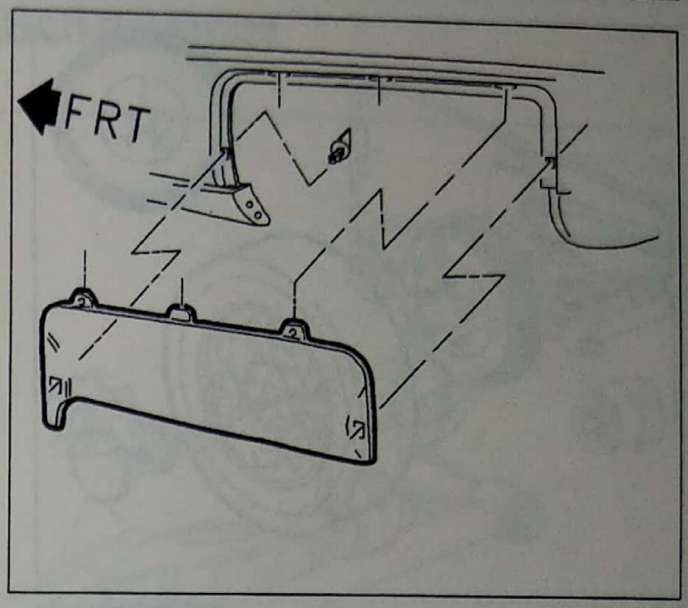
WHEEL STUD REPLACEMENT

REMOVAL AND INSTALLATION

1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual)
2. Remove wheel opening cover.



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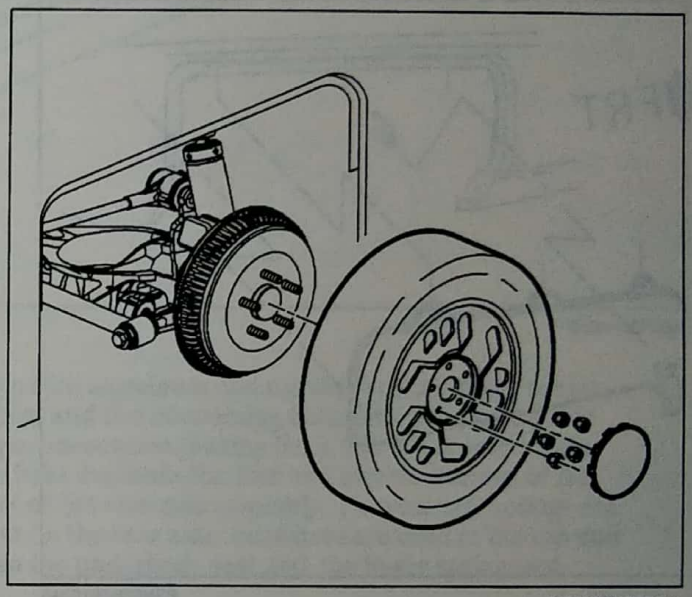
3. Remove road wheel from hub being serviced.

NOTICE: **Release park brake.**

4. Release park brake.
   a. Place keypad in **OFF** mode.
   b. Depress brake pedal.
   c. While brake pedal is depressed, push park brake apply/release button.
5. Remove brake drum.



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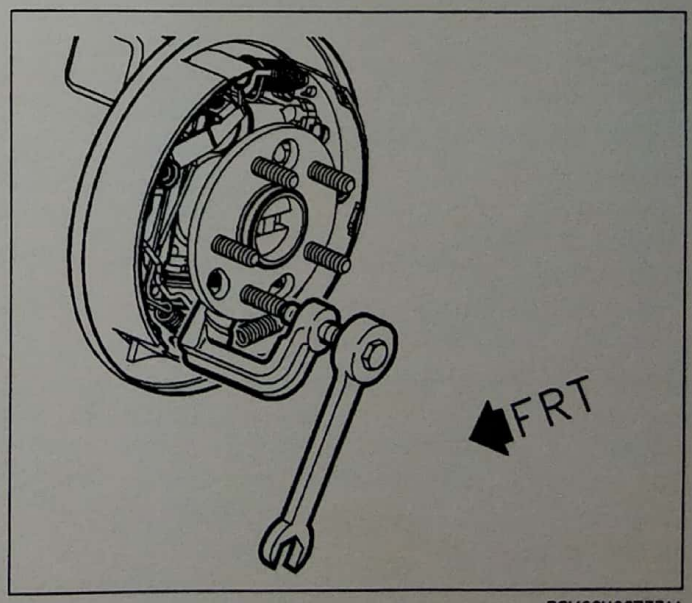
IMPORTANT: It may be necessary to remove the brake drum retainer that was installed during assembly. This retainer may be discarded once removed.

NOTICE: **Do not apply brake pedal or parking brake with rear drum removed. This may damage brake actuator assembly.**

6. Using SA91107NE (or equivalent) remove wheel stud.

IMPORTANT: It may be necessary to rotate hub to a location that will allow the removal/installation of the wheel stud.

7. Start new wheel stud into hub.
8. Place four washers over stud.
9. Install wheel mounting nut with flat side towards washer.
10. Using a wrench, tighten nut until stud is fully seated.
11. Install rear brake drum.



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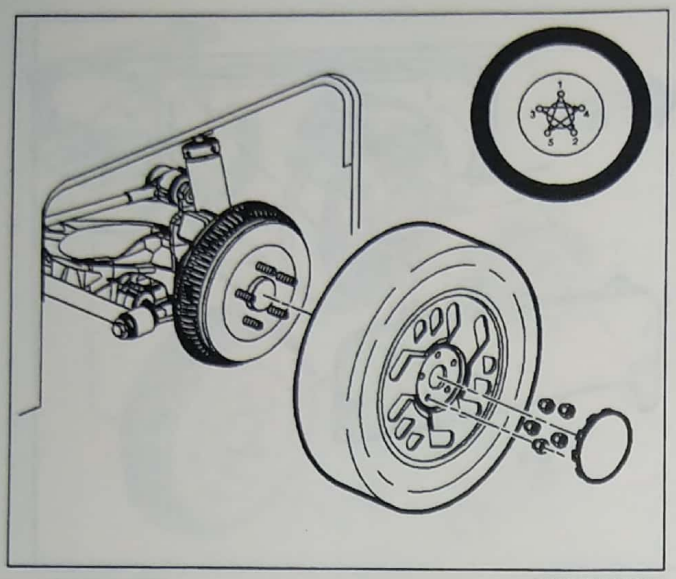
NOTICE: **Before installing wheels, remove rust or corrosion from wheel mounting surfaces and brake rotors. Failure to do so can cause wheel lug nuts to loosen in service.**



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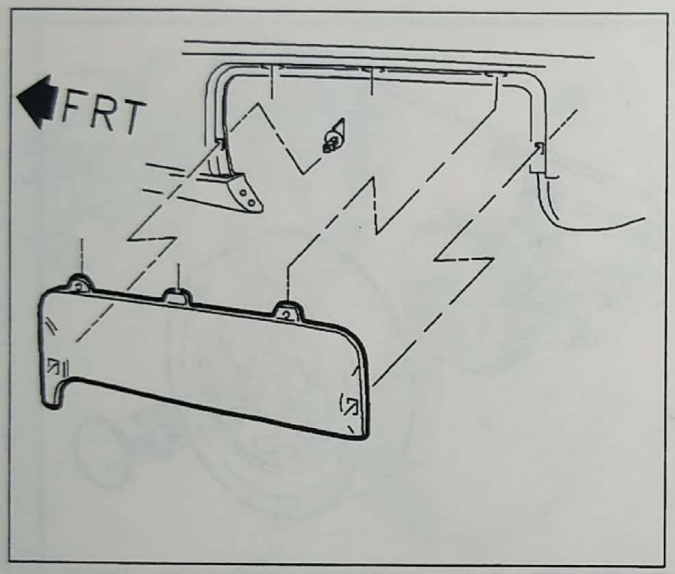
12. Position wheel on hub.
13. Install wheel lug nuts and tighten in a star pattern. Repeat tightening pattern to make sure torque is correct.

Torque: 120 N•m (89 ft−lbs)



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14. Install rear wheel opening cover and lower vehicle from hoist.

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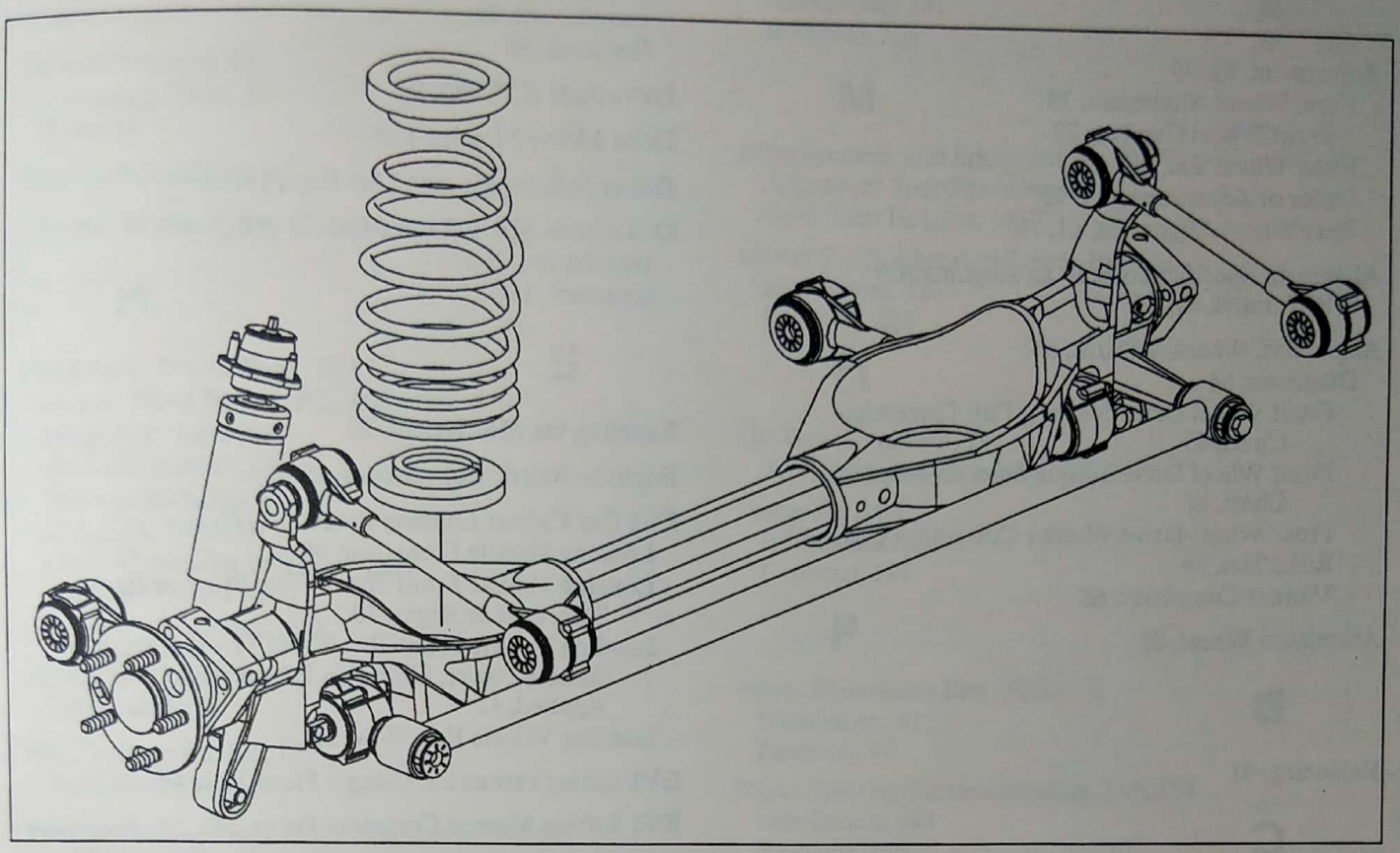
GENERAL DESCRIPTION



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The rear suspension on the EV1 consists of a rear axle assembly with aluminum end castings and a tubular center section. There are two coil springs, two twin tube shock absorbers and five connecting links with non-replaceable bushings. These five connecting links are composed of two upper suspension leading links, two lower suspension trailing links, and a track bar. The upper and lower suspension links maintain the fore and aft relationship of the rear axle to the body. The track bar controls the side movement of the rear axle assembly. The rear coil springs are retained between a seat on the underside of the body and a seat on the rear axle. Insulators are used at the top and the bottom of the rear coil spring, to isolate the coil spring from the underbody seat and the lower spring seat.

Although the rear suspension components are lubricated for life, they should be inspected periodically for damage and wear.

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EV1™ SERVICE MANUAL COMMENT FORM

Use this form if you have any suggestions or see any areas of opportunity for Electric Vehicle Service Manuals.

Service Manual(s) that apply _____

Page number(s) that apply _____

VIN (if applicable) or model and applicable options _____

_____

Describe in detail, the error found or the suggestion(s). Attach additional pages if necessary.

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Service Manual Contents

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- Wheels
- Tires
- Drive Axles
- Cradle
- Drive Motor Mounts
- Steering
- Front Suspension
- Rear Suspension
- Diagnosis
- General Description

NOTE: **Refer to the Index in the back of this manual or the Table of Contents in the front of this manual for location of specific component.**

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